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COMMUNICATIONS

A CLINICAL TRIAL OF A SYNTHETIC MYDRIATIC*
(Dimethylaminoethyl Benzilate Ethochloride)

BY

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GLASGOW

THERE was a possibility at one period of the recent war that a serious shortage of the mydriatics usually employed in ophthalmology might develop. Under the direction of Sir Robert Robinson a series of relatively simple compounds were prepared which might be expected to show mydriatic properties. This was done by Dr. Ing and Dr. Ford-Moore at the Dyson Perrins Laboratory, Oxford. These workers made a large number of synthetic mydriatics which were of four main chemical classes; choline derivatives, dimethyl- and diethyl-aminoethanol derivatives, piperidine derivatives and morpholine derivatives. Quantitative estimations of the mydriatic activities of these synthetic substances were carried out on mice and cats by Dr. Edith Bülbring and Mrs. Isabella Wajda in the Department of Pharmacology, Oxford. The general conclusion reached from these investigations on experimental animals was that dimethylaminoethyl benzilate ethochloride was an efficient atropine substitute for the immediate war problem, provided that this view were confirmed by trials in

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man. This substance was referred to as E.3 and this appellation will be used in the following account of certain clinical trials.

A 1 per cent. wt./vol. solution of E.3 in distilled water was made. Solutions of atropine sulphate 1 per cent. and of H. and C. (homatropine hydrobromide 1 per cent. and cocaine 2 per cent.) were also prepared. Three drop bottles with the dropper contained in the ground glass stopper were used for the trials. The size of drop delivered by the three stoppers was estimated by filling a 1·0 c.c. tuberculin syringe with drops delivered at the usual angle employed in putting drops into an eye and calculating the mean. The findings were:—

1. Bottle E.3 1 per cent. delivered a drop 0·043 c.c. average size
2. Atropine 1 per cent. ... ... 0·045 c.c. ,, ,,
3. H. and C. ... ... 0·051 c.c. ,, ,,

For clinical purposes the sizes were comparable, although greater accuracy of dosage might have been obtained by delivering the solutions into the conjunctival sac from a tuberculin or micro syringe.

Mydriatic effect

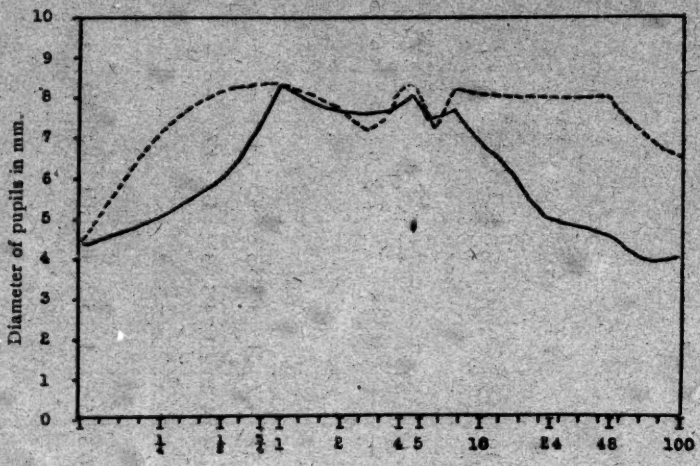
The size of the pupils was estimated by means of the pupillometer fitted to the driving wheel of a Morton ophthalmoscope before the drops were placed in the eyes. In five subjects two drops of E.3 were placed in the right eye and two drops of atropine in the left eye. Readings were taken of the size of the pupils at time intervals up to seven days. The mean distribution is shown in Table 1 A and B. The first line, A, shows the effect of E.3 upon the right eye and the second line, B, the effect of atropine. It will be observed that the effect of E.3 is neither so rapid nor so prolonged as that of atropine. By plotting the averages on a time scale of log. hours Diagram 1 was constructed. This confirmed the clinical impression that the effect of E.3 was less powerful than that of atropine.

Concurrently a similar series of comparisons was made between E.3 and H. and C. Ten subjects were investigated and the results are tabulated in Table 1 C and Table 1 D in a manner similar to the atropine group. Diagram 2 shows the results plotted in the same way as in the atropine series. It would appear that the action of E.3 is less rapid than H. and C. but of similar intensity. It is of course probable that the cocaine accelerates the mydriasis produced by homatropine, but the combined solution was used because it is the one frequently employed in routine work in ophthalmic clinics. When homatropine 1 per cent. was used alone the curves were very similar and are shown in Diagram 3. This is based upon the readings obtained from twelve patients.

TABLE I

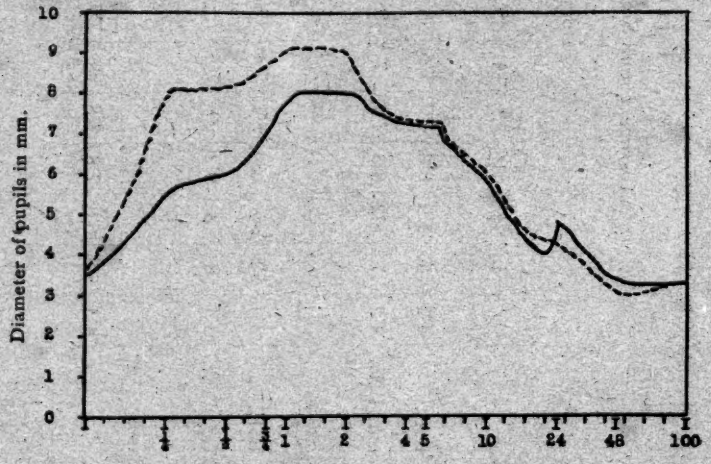
Average Pupil Size in Millimetres

GROUPS	HOURS													DAYS					
Five Cases	0	¼	½	1	2	4	5	6	8	10	15	20	24	2	3	4	5	6	7
A E.3 1 per cent. R.E. ...	4·2	5	5·9	8·2	7·7	7·5	8	7·5	7·7	—	—	—	5	4·7	3·8	4	3·7	3·8	4·3
B Atropine 1 per cent. L.E.	4·2	7	8·2	8·3	7·7	7	9	7	8·3	—	—	—	8	7·9	7·3	6·7	5·8	6	5·7
Ten Cases																			
C E.3 1 per cent. R.E. ...	3·4	5·5	6	8	8·1	7·4	—	7·3	6·3	5·8	4·2	4	4·8	3·8	4·3	4	—	—	—
D H. and C. L.E.... ...	3·4	8	8	9·2	9	7·4	—	7·2	6·3	6·3	4·2	4·3	4·3	3·2	3·5	3·7	—	—	—
Fifty-one Cases																			
E E.3 1 per cent.	4·5	5·8	6·8	7·8	7·8	8	7·7	7·1	7·1	6·5	5·6	5	5·2	4·1	4·1	3·5	3·5	4	4



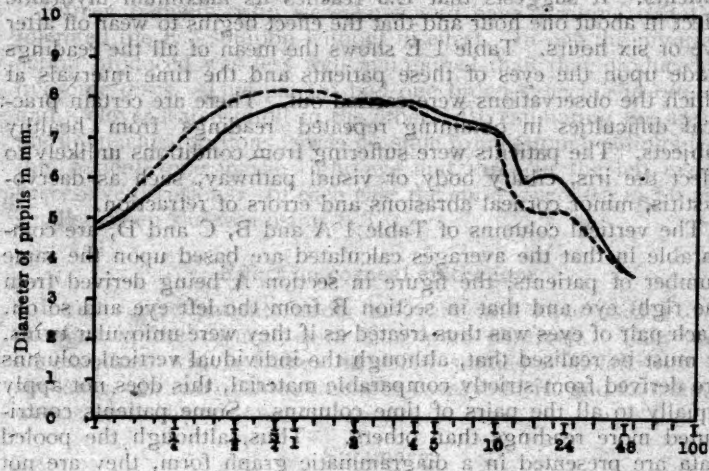
Time in log. hours. Continuous line—E.3 1% Dotted line—Atropine 1%

DIAGRAM 1.



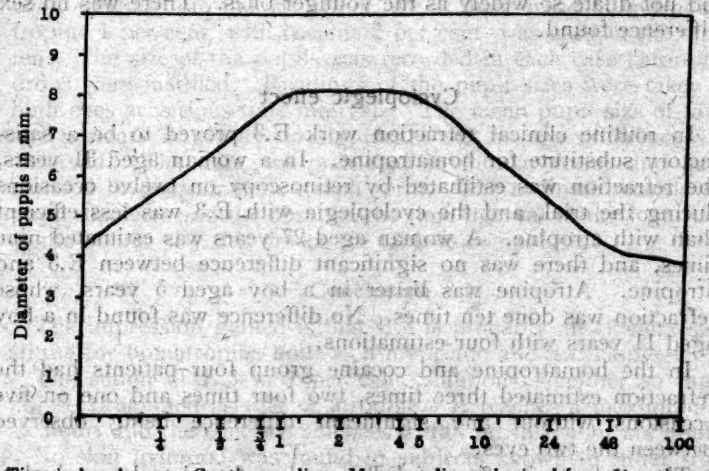
Time in log. hours. Continuous line—E.3 1%
Dotted line—Homatropine 1% and Cocaine 2%

DIAGRAM 2.



Time in log. hours. Continuous line—E.3 1% Dotted line—Homatropine 1%

DIAGRAM 3.



Time in log. hours. Continuous line—Mean readings obtained from 51 patients.

DIAGRAM 4.

Diagram 4 is founded upon repeated observations on fifty-one patients. It suggests that E.3 reaches its maximum mydriatic effect in about one hour and that the effect begins to wear off after five or six hours. Table 1 E shows the mean of all the readings made upon the eyes of these patients and the time intervals at which the observations were carried out. There are certain practical difficulties in obtaining repeated readings from healthy subjects. The patients were suffering from conditions unlikely to affect the iris, ciliary body or visual pathway, such as dacryocystitis, minor corneal abrasions and errors of refraction.

The vertical columns of Table 1 A and B, C and D, are comparable in that the averages calculated are based upon the same number of patients, the figure in section A being derived from the right eye and that in section B from the left eye and so on. Each pair of eyes was thus treated as if they were uniovular twins. It must be realised that, although the individual vertical columns are derived from strictly comparable material, this does not apply equally to all the pairs of time columns. Some patients contributed more readings than others. Thus, although the pooled data are presented in a diagrammatic graph form, they are not graphs in the strict sense.

The data were divided into four age groups, those under fifteen, between sixteen and forty, forty-one and sixty and over sixty. No significant difference was found, although the older patients did not dilate so widely as the younger ones. There was no sex difference found.

Cycloplegic effect

In routine clinical refraction work E.3 proved to be a satisfactory substitute for homatropine. In a woman aged 31 years, the refraction was estimated by retinoscopy on twelve occasions during the trial, and the cycloplegia with E.3 was less efficient than with atropine. A woman aged 27 years was estimated nine times, and there was no significant difference between E.3 and atropine. Atropine was better in a boy aged 5 years, whose refraction was done ten times. No difference was found in a boy aged 11 years with four estimations.

In the homatropine and cocaine group four patients had the refraction estimated three times, two four times and one on five occasions without any significant difference being observed between the two eyes.

The cycloplegic effect of E.3 was thus found to be equivalent to homatropine and cocaine, but less powerful than atropine for routine clinical work. No opinion was formed as to the time taken for the cycloplegic effect to wear off.

Atropine irritation

Fifteen patients, who were known to have atropine irritation, tolerated the E.3 solution without ill effect. In one the mydriatic action produced was less well maintained than that produced by hyoscine discs. This patient had one broad synechia in one eye and a clover-leafed pupil in the other. By estimating the arcs of the unattached portions it was possible to take four readings from this patient—one in the right eye and three in the left eye on successive occasions. In each case the curves were 0·5 to 1·0 mm. smaller when she was using E.3.

Effect on corneal epithelium

In over fifty patients under my care who have used E.3 no changes in the corneal epithelium were observed. They were all examined with a loupe and a few studied in detail with the slit-lamp. In two or three cases the usual mild H. and C. changes were seen in the left eye.

Summary

A clinical trial of the mydriatic and cycloplegic effect of dimethylaminoethyl benzilate ethochloride (E.3) on human subjects is described. Two drops of a 1 per cent. solution were placed in the right conjunctival sac of fifteen patients; atropine 1 per cent. was put into the left eye of five of those patients and homatropine 1 per cent. with cocaine 2 per cent. was used in the other ten. The size of the pupils was recorded in each case before the drops were instilled. Readings of the pupil sizes were taken in both eyes at various time intervals. The mean pupil size of fifty-one patients is given; no significant sex or age difference was observed. The data are presented in tabular form, and summarised in diagrammatic graph form. The ordinate records the pupil diameter and the abscissa the time interval in the logarithm of the hours. By this device the table is compressed.

Conclusion

The impression gained is that E.3 is probably an efficient substitute for homatropine both as a mydriatic and a cycloplegic.

The action of E.3 in 1 per cent. solution is neither so rapid nor so prolonged as that of atropine. It reaches a maximum in an hour, and the effect commences to fall off in five or six hours.

No skin irritation was found in subjects known to suffer from atropine sensitivity. No changes were observed in the corneal epithelium.

This clinical investigation was originally carried out on behalf of the Ministry of Supply.

A NEW SYNTHETIC MYDRIATIC*

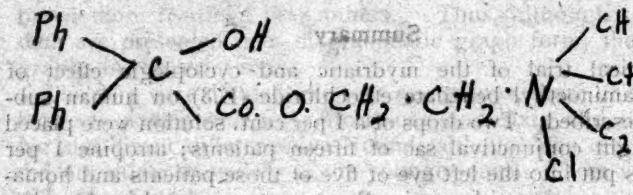
BY

IDA MANN

OXFORD

OWING to the serious shortage of atropine in England during 1942-43, work on the synthesis of mydriatics was undertaken by Drs. Ing and Ford-Moore at the Dyson Perrins Laboratory, Oxford. A number of substances were produced and tested experimentally and clinically. One of these, which came to be generally known by its code name, E.3, proved of great clinical value and is likely to be of permanent use to ophthalmologists.

This substance is the benzilic ester of hydroxyethyl-dimethyl-ethyl-ammonium chloride, its formula being:



A 1 per cent. solution was used for trial. A drop of this in the eye produced mydriasis and cycloplegia in monkeys. No general symptoms were apparent. Toxicity trials in mice were satisfactory, and in cats the substance produced sleepiness, whereas atropine leads to excitation and convulsions. Clinical trials on man were therefore begun.

The patients can be divided into 4 groups. In the first group, E.3 was used on normal, healthy eyes to test its mydriatic and cycloplegic action. In the second group, it was used for treatment of diseases for which atropine would normally be given. In the third group, it was used as a substitute for atropine in cases in which atropine or hyoscine had produced general symptoms, and in the fourth group it was used in cases known to be sensitive to atropine or hyoscine and to show allergic eczema of the lids (atropine irritation) from their use.

Fifty-eight patients were studied.

Group 1. *Healthy eyes.*—Two drops of a 1 per cent. solution of E.3 were dropped into one or both eyes of 4 normal individuals

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at an interval of a quarter of an hour. Their ages were respectively, 2, 8, 59 and 76 years. In the youngest child dilatation of the pupil was slow and was not quite complete in an hour. This was very similar to the expected action of atropine, which is slow in young children. In the boy aged 8 years, full mydriasis and paralysis of accommodation were reached in less than an hour. In the two older patients, dilatation began in twenty minutes and was complete in thirty minutes from the time of the first drop. Eserine 0·5 per cent. was then dropped into the eye twice at ten minute intervals. In the patient aged 59 years, the pupil had regained its previous size (but was not pinpoint) in twenty minutes. In the older patient, the eserine had no effect. The pupil remained dilated until the following morning. The tension was normal and two applications of eserine then restored the pupil to normal (though it did not become pinpoint).

It would appear therefore that E.3 can be used for diagnostic and refractive purposes in the same way as atropine. Its action is more easily reversed by eserine than is that of atropine, but in old people it is not so safe as is homatropine. It appears to lie between atropine and homatropine in its strength of action on normal eyes. None of the patients made any complaint of discomfort from its use.

Group 2. *Treatment cases.*—E.3 was next used on 6 cases of disease. Three of them were corneal ulcers. In one case atropine, and in another oily homatropine and cocaine had been used once at the beginning of the treatment; in the third, E.3 was used throughout. All three ulcers healed, two after a week's use of E.3, the third after 14 days. One of the remaining three patients was a case of tuberculous cyclitis who had been on atropine for some time. This was changed to E.3. The effect appeared to be similar, though more frequent instillations were necessary to maintain maximum dilatation, the best result being obtained if E.3 was used three times a day. Two operation cases were then treated, one of capsulotomy, in which E.3 was used before and twice a day for four days after operation with a good result, and the other, a cataract extraction in which atropine was used from the beginning. This eye was slow in settling down, and E.3 was given twice a day for two months with a final good result and no ill effects from its continued use.

Group 3. *Cases with general toxic symptoms from atropine and hyoscine.*—This group contained 6 patients (two chronic cyclitis, two post-operative cyclitis, and two cataract extractions, one in a diabetic). All these patients had previously been treated with atropine or hyoscine, which had produced very unpleasant general symptoms, dryness of the mouth, itching of the skin, general discomfort and, in 3 cases, mental confusion. None of

them had shown any local signs of atropine irritation. The two cases of cyclitis were treated with E.3 twice or three times daily, one for six months, the other for two months with good local results and no recurrence of general symptoms. The two cases of post-operative cyclitis used E.3 drops twice a day for about six weeks with no general symptoms. The two cases of cataract extraction were patients who had had severe general symptoms from atropine and hyoscine used after a previous extraction. In both cases E.3 was used for the second eye, in one case for eight weeks and in the other for four without any ill effects, the mydriasis being satisfactory, and the patients making no complaint of local or general symptoms.

E.3 is therefore without systemic toxic effects in cases showing general idiosyncrasy to atropine and hyoscine.

Group 4. Patients known to have atropine irritation.—This group contains 42 cases and is by far the most interesting, as it shows that we now possess in E.3 a mydriatic of so completely different a chemical composition from atropine that it can safely be used in cases of severe atropine irritation.

In the 42 cases of atropine irritation under review, 16 had shown severe allergic eczema of the lids and face in less than a week after beginning treatment with atropine. Some of these were sensitive to homatropine and to hyoscine as well. In others, these were not tried, E.3 being substituted as soon as the atropine irritation appeared. In 17 cases the irritation did not appear until the patient had used atropine for more than a week. In the remaining 9 cases, the exact length of time of treatment with atropine before the irritation began is not known.

In all these cases, E.3 was substituted for atropine without waiting for the irritation to subside. In them all the patients experienced relief at once; there was steady subsidence of the oedema and itching and however long (in one case up to seven months) the E.3 was continued, there was no return of the symptoms.

Although a much larger number of cases will be required before we are certain that E.3 never produces an allergic reaction, we can certainly say from these 42 patients that it already gives us a very efficient non-irritating substitute for atropine and with a stronger mydriatic action than homatropine or hyoscine. In most cases it was necessary to instil it twice a day and in some three times, but no symptoms were complained of and the course of the disease being treated was what one would have expected if atropine had been used.

The diseases from which these 42 patients were suffering are shown in the following table, as well as the time they were using E.3:—

Cases with atropine irritations

Type of case:		Sympathetic ophthalmitis	
Corneal ulcer		Acute iritis	
Interstitial keratitis		Chronic irido-cyclitis	
Delayed mustard gas keratitis		Cataract extraction	
Scleritis		Capsulotomy	
Endophthalmitis		Post-cataract irido-cyclitis	
Atropine irritation developed in:		Treated with E.3 without irritation for:	
Less than 1 week ...	16 cases	Less than 1 week ...	6 cases
More than 1 week ...	17 cases	One week to 3 months	32 cases
Uncertain	9 cases	More than 3 months ...	4 cases
Total ...	42	Total ...	42

Summary

The synthetic mydriatic known as E.3 is non-irritating, non-toxic and in action on the eye lies between atropine and homatropine. It is in all respects suitable as a substitute for atropine though it may have to be used more frequently.

OCULAR FINDINGS IN TROPICAL TYPHUS*

(Tsutsugamushi or Japanese River Fever)

BY

E. A. DONEGAN, Captain, R.A.M.C.

TROPICAL typhus or Tsutsugamushi, Japanese river fever or scrub typhus has long been recognised as very closely related to the more widely known louse-borne typhus met with in the Balkans and Russia during the War 1914-1918 and again in this War in Italy, and also to the tick borne typhus of world wide distribution.

It was first described in 1878. In Mandalay, 1925, cases occurred in a military camp (Fletcher) and were divided into two types: a.W. form or urban type and a.K. form found in country districts and plantations. It is probable that the W. form is identical with Brill's disease, which is flea borne. A complete study of tropical typhus was carried out by Anigstein, 1933.

The causative organism is Rickettsia orientalis, its insect vector

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one of the mites-trombicula akamushi or deliensis. These mites are usually found where there is deadwood and low scrub and where rotting vegetation is plentiful. The reservoirs of the disease are the many varieties of tropical rats and also some birds, though these do *not* apparently suffer. The larval form of the trombicula lives in grass, whence it is picked up by rodents or birds. It is therefore a place infection and often was found to be very well delimited in distribution.

The cases in which the ocular findings are to be described were apparently infected in the hilly tracks of the Arakan, on the border of India and Burma, some 60 miles east of the supply base of Chittagong, in Bengal, near the village of Mowdok. The area had been occupied by the Japanese soon after the commencement of the monsoon in June, 1944. The bulk of the cases were West Africans (95) and six cases of the disease in Europeans are included. The infected area is hilly and well watered and the slopes are covered with thick bamboo, except where there had been cultivation by the local villagers before the advent of hostilities. Cultivation having been discontinued, most of the patches and farms had become overgrown with grass and low lying scrub and included much old secondary scrub and deadwood. The writer had experience of this area during the campaign in the Kaladan River valley in the months December, 1943, to June, 1944. Until April, 1944, no case of typhus had been seen by the Medical Officers working with the 81 West African Division. Then the temperature was high and the humidity very great. There were fourteen cases in all—two in Europeans and twelve in West Africans. The history given was that of increasing severe malaise and fever, lasting for three to four days, prior to admission to the Field Ambulance. Owing to the difficulties inherent in the campaign, evacuation to the base was mainly carried out by air, usually by Fox Moth planes, carrying one lying and one sitting case. It so happened that at the time of occurrence of these cases, the Field Ambulance had been stationary for almost a fortnight, due to lack of evacuation facilities, and there were at one time twelve of these "N.Y.D. Fevers" in the unit. The patients presented the following combination of signs and symptoms: intense headache and apathy, with enlargement of the spleen and liver, some signs of pulmonary congestion and invariably marked constipation. Conversation with them was difficult, but rational, even in those most severely ill. The conjunctivae were hyperaemic and there was inability or, as was thought more likely, lack of desire to accommodate. There was no complaint of defective vision. Only two cases were examined ophthalmoscopically, in an attempt to exclude meningitis. No intra-ocular disturbance was noted in either case.

									Lab. Findings				Ophthalmological Findings						
Case Number	Age	Date of onset	Day of disease on admission	Duration/Height of pyrexia	Toxicity	Blood pressure	Spleen	Chest	Albuminuria	C.S.F. Examination P.=Protein C.=Cells	Agglutination O.X.K. Titre	Complications and intercurrent diseases	Conjunctival hyperaemia	Vitreous Haze	Disc—hyperaemia	Disc—marginal blurring	Disc—swelling	Day of disease—ophthalmic exam.	Day of disease—ophthal. clear
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
E 1	28	29/10	12	11/103	+ + +	115/75	+ +	—	—	P.65 C.16	1/2500	Nil	+	+	+	+	±	15	31
E 2	22	30/10	2	3/103	±	N.K.	—	—	—	N.D.	1/2500	Nil	—	—	—	—	—	21	21
E 3	27	21/10	17	10/103	+ +	130/75	—	+	—	N.D.	1/625	Nil	+ +	+	+	+	—	19	30
E 4	25	6/11	9	13/104	+ +	100/75	+	+ +	—	P.30 C.40	1/125	Nil	+	+	+	+	—	12	30+
E 5	35	4/11	9	17/104	+ +	120/80	—	+ +	—	P.35	1/250	Nil	+ +	—	±	+	—	12	39+
E 6	23	26/10	5	16/103	+ +	100/80	+ +	+	—	N.D.	1/250	Oedema of ankles	+	—	—	+ +	—	9	14+
A 1	N.K.	31/10	6	19/103	+ +	98/52	+	+	+ + +	N.D.	1/250	Lung abscess	+	+	+	+	+ 2D.	19	81
A 2	23	10/11	12	8/102	+ +	110/70	+	+	—	N.D.	1/1000	Nil	—	+	+	+	—	14	35
A 3	32	24/10	11	20/101	+ +	96/60	—	+	—	N.D.	1/1250	Amoebic dysentry	+	—	—	±	—	27	47
A 4	27	17/10	15	27/103	+	98/60	+ + +	+ +	—	N.D.	1/50	Nil	—	+	—	±	—	32	54
A 5	N.K.	N.K.	4	13/103	+ +	90/60	+	+	—	N.D.	1/1250	Synovitis	+	±	—	—	—	18	32
A 6	28	28/10	8	13/102	+	126/90	+ +	+	+ +	P.60 C.42	N.E.	Deafness ; vomiting	+	—	—	±	—	21	45
A 7	N.K.	20/11	3	6/104	+ + +	118/60	—	+ +	—	N.D.	N.D.	Died	±	—	±	—	—	7	—
A 8	27	16/11	8	9/103	+	114/80	+	+ +	+	N.D.	1/500	Nil	—	—	+	—	—	10	10+
A 9	42	24/10	11	9/103	+	96/60	—	—	—	N.D.	1/625	Pneumonia	—	—	—	—	—	25	25
A10	N.K.	27/10	7	9/105	+	140/80	+ +	+	+	N.D.	1/625	High B.P.—210/124	—	—	—	—	—	22	22
A11	N.K.	13/11	10	9/103	+	88/64	+ +	—	±	N.D.	1/125	Nil	+	—	+	—	—	13	31
A12	N.K.	13/11	11	11/102	+ +	102/72	±	+	—	N.D.	1/250	Nil	±	±	—	—	—	13	31
A13	31	28/10	4	10/105	+ +	80/50	+	+	+	N.D.	250	Nil	+	±	+	+	+	22	60
A14	26	16/11	5	15/103	±	102/70	±	—	+	N.D.	1/250	Nil	+	+	—	—	—	10	28
A15	26	11/11	12	?/103	+	100/76	+	+	±	N.D.	1/125	Nil	±	±	+	+ +	±	12	30
A16	N.K.	13/11	8	11/101	±	100/80	—	—	—	N.D.	1/340	Nil	+	—	—	—	—	20	29
A17	24	31/10	5	6/106	+	108/70	+	+ +	+	P.60 C.35	1/250	Pneumonia	+	—	—	—	—	19	19
A18	N.K.	30/10	7	9/105	+	130/70	±	—	+ +	N.D.	1/250	Jaundice	—	+	—	—	—	20	41
A19	N.K.	29/10	4	8/103	+ +	98/70	+	—	+	N.D.	1/1250	Nil	+	—	—	—	—	23	23
A20	26	26/10	10	10/104	+	106/70	+	—	+ +	P.35 C.22	1/2500	Nephritis	+	—	—	—	—	26	26
A21	N.K.	28/10	8	14/103	+	92/60	+	—	—	N.D.	1/1250	Nil	+	—	—	—	—	23	23

Case Number	Age	Date of onset	Day of disease on admission	Duration/Height of pyrexia	Toxicity	Blood pressure	Spleen	Chest	Albuminuria	C.S.F. Examination P.=Protein C.=Cells	Agglutination O.X.K. Titre	Complications and intercurrent diseases	Conjunctival hyperaemia	Vitreous Haze	Disc—hyperaemia	Disc—marginal blurring	Disc—swelling	Day of disease—ophthalmic exam.	Day of disease—ophthal. clear
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
A22	39	23/10	12	9/102	++	116/76				N.D.	1/625	Nil						28	46
A23	N.K.	30/10	6	14/101	+	94/60				N.D.	1/1250	Nil	+					20	58
A24	29	14/11	10	N.K.	+	95/60				N.D.	1/365	Nil	+					11	11
A25	23	28/10	9	12/102	+	98/62	+			N.D.	1/1250	Nil						22	22
A26	24	29/10	8	10/104	+	100/60				N.D.	1/2500	Jaundice						21	34
A27	N.K.	27/10	10	24/103	+	96/60				N.D.	1/625	Nil	+		+	+	+ ID.	22	36
A28	N.K.	8/11	14	15/103	+	110/66	+		+	N.D.	1/250	Died	+	+	+	+	+	15	
A29	28	26/10	10	8/104	+	110/66	+	+	+	N.D.	1/625	Nil	+	+	+	+	+	23	23
A30	N.K.	28/10	9	10/101	+	132/74				N.D.	1/250	Nil	+					23	21
A31	N.K.	20/10	12	11/104	+	108/60				N.D.	1/1250	Nil	+					21	33
A32	N.K.	28/10	4	9/104	+	142/86	+	+	+	N.D.	1/250	Bl. Urea 60%	+					33	24
A33	N.K.	1/11	5	8/103	+	106/58	+			P.40	1/125	Nil	+	+	+	+		24	40
A34	N.K.	23/10	12	11/103	+	110/62	+	+		N.D.	1/625	Nil	+	+	+	+		19	
A35	N.K.	23/10	12	N.K.	+	110/68	+	+		N.D.	1/625	Nil	+	+	+	+		26	35
A36	N.K.	13/11	7	Nil		120/70	+			N.D.	1/250	? Basal T.B.	+	+	+	+	ID.	28	26
A37	41	8/11	27	18/105		140/80	+	+		P.80	1/1000	Nil	+	+	+	+		27	46
A38	N.K.	16/11	6	14/103	+	110/80				C.10	1/5000	Nil	+	+	+	+		31	41
A39	N.K.	22/10	13	13/104	+	120/76	+		+	N.D.	1/625	Nil	+	+	+	+		10	10
A40	24	23/10	13	12/?	+	120/70	+		+	N.D.	1/625	Nil	+	+	+	+		29	52+
A41	N.K.	22/10	10	13/104	+	120/70		+		B.D.	1/500	Nil	+	+	+	+		30	34
A42	21	31/10	61	8/104	+	110/70	+			N.D.	1/1250	Nil	+	+	+	+		30	30
A43	33	23/10	12	13/?	+	110/70				N.D.	1/1250	Nil	+	+	+	+		22	22
A44	25	23/10	13	14/104	+	116/70	+			N.D.	1/1250	Nil	+	+	+	+		22	26
A45	27	28/10	8	12/101	+	120/70				N.D.	1/1250	Nil	+	+	+	+		29	19
A46	22	23/10	10	14/102	+	104/60	+	+		P.30	1/1250	Nil	+	+	+	+		35	35
A47	25	31/10	5	12/103	+	110/80	+		+	C.15	1/1250	Nil	+		+			40	40
										P.60								22	22
A48	N.K.	7/11	16	16/?		110/70	+			C.35	1/1250	Nil	+		+			33	33
A49	30	19/10	15	19/104	+	130/80	+	+		N.D.	1/625	Nil	+	+	+	+	±	33	44
							+			N.D.									

Lab. Findings] Ophthalmological Findings

A48	N.K.	7/11	16	16/?	—	110/70	+													
A49	30	19/10	15	19/104	+	130/80	+ + +	+	±	N.D.	1/625	Nil	+	+	+	+	±	33	44	

									Lab. Findings				Ophthalmological Findings						
Case Number	Age	Date of onset	Day of disease on admission	Duration/Height of pyrexia	Toxicity	Blood pressure	Spleen	Chest	Albuminuria	C.S.F. Examination P. = Protein C. = Cells	Agglutination OXK Titre	Complications and intercurrent diseases	Conjunctival hyperaemia	Vitreous Haze	Disc—hyperaemia	Disc—marginal blurring	Disc—swelling	Day of disease—ophthalmic exam.	Day of disease—ophthal. clear
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
A50	19	23/10	11	15/104	+	120/90	—	—	—	N.D.	1/625	Nil	—	+	+	+	—	30	48 +
A51	21	23/10	14	17/104	+	120/80	—	—	—	N.D.	1/1250	Nil	+	+	+	+	—	29	48 +
A52	N.K.	14/11	9	10/103	±	120/80	±	—	+	N.D.	1/625	Nil	—	—	—	—	—	26	26
A53	48	19/11	4	17/101	+ +	82/62	—	—	—	N.D.	1/250	Nil	+	+ +	+ +	+ +	+ 1.5D.	16	24
A54	N.K.	4/11	9	10/102	+	—	—	—	—	N.D.	N.K.	Gangrene digits	+	+	+	—	—	15	15 +
A55	N.K.	27/10	13	10/103	+	102/60	—	+ + +	+	P.40 C.45	1/625	Lung abscess	+	+	—	+	+ 1D.	16	36 +
A56	N.K.	28/11	11	10/103	+ + +	100/70	+	—	—	N.D.	1/50	Nil	+	—	+	+	—	15	15 +
A57	N.K.	30/10	9	9/103	+	86/48	—	+ + +	+ +	N.D.	1/250	D. Pneumonia; Oedema hand and feet. Deafness	±	—	±	±	—	33	—
A58	N.K.	1/11	6	19/104	+ +	90/60	+	—	+	N.D.	1/250	Optic atrophy. Oedema hand and feet	+	+	—	+ +	+	18	—
A59	N.K.	29/10	12	5/102	+	130/80	+	—	±	N.D.	1/1250	Nil	—	—	—	—	—	34	34
A60	27	11/10	26	10/104	—	160/80	—	+	+	N.D.	1/625	Bl. urea 220 mgm.	—	—	+	—	—	38	38 +
A61	N.K.	30/10	11	11/103	+	108/76	+ + + +	+	—	N.D.	—	Optic Atrophy Kahn +. C.F. 2 ft.	+	—	—	+	—	18	49
A62	26	25/10	16	13/103	+ +	84/50	+ + + +	+	—	P.60 C.28	1/250	Splenic infarct	+	+ +	+ +	+ +	+ 1.5D.	23	49 +
A63	28	13/11	35	12/104	—	N.K.	+ +	—	—	P.36 C.5	1/15000	Nil	—	—	—	—	—	36	36
A64	N.K.	21/10	20	6/103	+	96/66	+ +	+	—	N.D.	1/500	Nil	—	+	+	+	+	41	52
A65	N.K.	29/10	12	11/102	±	114/68	±	±	—	N.D.	1/50	Nil	—	+	—	—	—	34	44 +
A66	27	31/10	12	12/104	+	110/74	—	+	—	N.D.	1/250	Arthritis knees	+	—	+	+ +	—	32	44 +
A67	N.K.	7/11	5	12/103	—	120/278	—	±	+	N.D.	1/250	Schist. Haem.	—	—	±	—	—	5	5
A68	34	25/10	12	7/103	—	124/80	—	—	—	N.D.	1/1250	Nil	+	—	±	—	—	24	—
A69	36	15/10	22	17/103	+	120/70	—	—	—	N.D.	1/250	Pustular Rash	±	—	—	—	—	48	48
A70	25	25/10	12	7/102	+	104/60	+ +	+	—	N.D.	1/625	Nil	—	—	—	—	—	24	24
A71	25	27/11	10	4/102	—	118/86	—	—	—	N.D.	1/1250	Nil	—	—	—	—	—	16	16
A72	24	20/11	17	5/102	—	100/50	—	—	—	N.D.	1/500	Nil	—	—	±	—	—	29	29
A73	23	26/10	11	N.K.	—	124/70	+	—	—	N.D.	1/250	Pharyngitis	—	—	—	—	—	37	37

									Lab. Findings				Ophthalmalogical Findings						
Case Number	Age	Date of onset	Day of disease on admission	Duration/Height of pyrexia	Toxicity	Blood pressure	Spleen	Chest	Albuminuria	C.S.F. Examination P.=Protein C.=Cells	Agglutination O.X.K. Titre	Complications and intercurrent diseases	Conjunctival hyperaemia	Vitreous Haze	Disc=hyperaemia	Disc—marginal blurring	Disc—swelling	Day of disease—ophthalmic exam.	Day of disease—ophthal. clear
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
A74	N.K.	28/10	12	14/103	+ +	86/50	+	+ +	—	R.30 C.16	1/50	Death	+	—	—	—	—	21	—
A75	N.K.	25/10	16	7/102	+	100/60	+ +	—	—	N.D.	1/250	Nil	+	—	—	—	—	28	38
A76	34	3/11	8	5/102	+	112/72	—	—	—	N.D.	1/125	Nil	—	—	—	—	—	29	29
A77	22	6/11	5	8/103	+	84/54	+ + +	—	—	N.D.	1/250	Nil	—	—	—	+	—	27	27 +
A78	26	3/11	3	3/105	±	100/72	—	—	—	N.D.	1/1250	Nil	+	—	±	—	—	12	30
A79	30	30/10	7	5/101	+ +	128/68	+ + + +	—	—	N.D.	1/1250	Nil	—	—	+	—	—	16	32
A80	28	1/11	4	5/103	+ +	98/62	+	+ +	—	N.D.	3/50	Nil	+ + +	±	—	—	—	31	42
A81	24	4/11	6	9/104	+	88/54	—	+ +	—	N.D.	1/2500	Nil	±	—	—	—	—	28	28
A82	N.K.	29/10	11	9/104	+	128/70	+	—	—	N.D.	1/625	Adenitis Oedema of penis	—	—	—	—	—	20	20
A83	N.K.	28/10	12	10/102	—	116/72	—	—	—	N.D.	1/250	Nil	+	—	+	±	—	20	20 +
A84	28	12/10	25	6/103	—	120/64	—	—	—	N.D.	1/250	Nil	—	—	—	—	—	36	36 +
A85	24	23/10	9	6/103	+ +	118/64	—	—	—	P.95 C.38	1/500	Nil	+	+	+	+ +	+	21	21 +
A86	N.K.	1/11	10	8/104	+ +	120/74	—	+	+ +	N.D.	1/125	Died	+	+	+	+	+	20	—
A87	28	19/11	23	7/405	—	124/78	—	—	—	N.D.	1/125	Nil	+	—	—	—	—	24	24
A88	N.K.	31/10	7	N.K.	—	104/70	+	—	+	N.D.	1/250	Nil	—	—	+	—	—	18	32 +
A89	N.K.	25/10	13	N.K.	+	124/80	—	—	—	N.D.	1/50	Nil	+	—	—	—	—	24	24
A90	N.K.	29/10	28	6/100	+	150/94	—	—	—	N.D.	1/250	Nil	+	—	—	—	—	34	34
A91	26	18/11	30	N.K.	+	N.K.	—	—	—	P.36 C.6	1/300	Nil	—	—	+	+	—	30	30 +
A92	30	27/10	11	3/100	+ +	112/72	—	—	—	N.D.	1/625	Maculo-papular rash	—	—	—	—	—	22	22
A93	N.K.	6/12	31	8/103	+ +	126/84	—	—	—	N.D.	1/1250	Microcytic anaemia Ankylost. duod.	+	+ +	+ +	+ + +	+ 3D.	32	32 +
A94	N.K.	1/12	6	4/103	+ +	106/72	+ +	—	—	N.D.	1/250	Nil	+	—	—	±	—	53	53 +
A95	N.K.	4/11	9	21/102	+ + +	102/75	—	+	—	N.D.	1/250	Dysentry-cellulitis	+ +	+	+ +	+ +	+ 1D.	16	32 +

Col. "H" — + = 1 finger's breath below costal margin.

Col. "M" — includes complications not necessarily due to typhus.

Col. "A" — E=European; A=West African.

Col. "K" — P.=Protein; C.=White cells.

Col. "R" — D.=Dioptres, as measured by ophthalmoscope.

In November and December, 1944, acting as Ophthalmic Specialist to a group of 3 Hospitals dealing with West African, Indian and European troops, one hundred and one cases, diagnosed clinically as tropical typhus whose sera agglutinated b. proteus OXK (Kingsbury strain), were examined.

The first case seen was a British Officer (Case No. E.6) serving with West African Troops in the area described. The Officer in charge of the case, Major (now Lt.-Col.) Allen, R.A.M.C., had asked for an opinion on the fundi. The note made was "Examination of the fundi showed some marginal blurring of the optic discs in both eyes without hyperaemia or swelling." The patient gave a history of "severe kidney trouble" as a boy and it was concluded that though there were no other ocular or systemic residual signs it must be a remnant of a previous albuminuric neuro-retinitis. Some days later, Major D. E. Rodger, R.A.M.C., Medical Specialist of the West African Hospital, asked for an opinion on the fundi of a West African case of typhus. The man (Case A.62) was very ill and it was with difficulty that the examination was carried out. Photophobia was very marked. The conjunctivae were hyperaemic. The discs showed marked hyperaemia, with swelling of + 2 D., with a peripapillary band of retinal oedema about 2 mm. broad. There was slight venous congestion, but no haemorrhages or exudates were seen. The maculae were clear and he was able to count fingers at approximately 6 metres with either eye. In spite of the visual acuity, optic neuritis was diagnosed. Immediately afterwards, another convalescent typhus was examined (Case A.61), whose discs showed a typical post-papillitic atrophy, with visual acuity reduced to counting fingers at 2 feet with either eye. His blood was examined and gave a strong Kahn positive reaction.

It was then decided to examine all the cases diagnosed as typhus, and a survey was begun, the detailed results of which are given in the table below.

The ocular changes in tropical typhus may be summarised as follows. In the acute stage, the conjunctivae are generally hyperaemic, without involvement of the cornea, clearing about the fourteenth day. The fundi typically show a disc in which there is pathological hyperaemia with an overlying central vitreous haze, with its margins blurred in at least two quadrants, often accompanied by swelling. The vessels show little or no change, even in patients with marked cerebral symptoms, as they give no suggestion of venous stasis. The hyperaemia disappears once the acute stage of the disease is over and the fever has subsided. The vitreous haze then clears about the end of the third week. The last sign to disappear is the marginal blurring, which

Col. "M" — includes complications not necessarily due to typhus. Col. "R" — D. = Dioptres, as measured by ophthalmoscope.
Col. "A" — E = European; A = West African.

may persist in some cases for more than a month after the subsidence of systemic signs of the disease.

The post-mortem systemic findings in Cases A.28 and A.86 are given :—

A.86. Post-mortem

Thorax: The right and left lungs are deeply congested—bronchial pneumonia—bronchial glands. Pericardium is normal. Myocardium shows flabby dilatation. The endocardium is normal.

Abdomen: The intestines are healthy; the liver shows venous congestion and fatty degeneration. Spleen greatly enlarged, friable and congested. Kidneys show fatty degeneration.

Cranium: The meninges are normal, the cerebrum soft and oedematous and deeply congested. Excess of cerebro-spinal fluid in the ventricles.

A28. Post-mortem

Cranium: Cerebrum deeply congested, as are the cerebellum and pons. Microscopy of globe enucleated twenty minutes post-mortem: vessels in region of the optic disc showed intense congestion and there was a slight degree of perivascular round cell infiltration. The optic nerve was normal in appearance.

Discussion

A total of 101 cases are described in their salient features. Of these, 4 died giving a mortality rate of approximately 4 per cent. While 32 showed vitreous haze—taken as a more reliable sign of optic nerve disturbance—only two cases of optic atrophy were seen, in one of which the serum gave a strongly positive Kahn reaction. All the 6 European cases were examined on Snellen charts and perimeter and Bjerrum screen. When convalescent corrected vision in all cases was at least 6/6 in both eyes and there was no contraction or scotomata found. During the acute stage of the disease it was not possible to estimate the visual acuity. This was carried out during convalescence and showed normal readings in West Africans as well. It was *not* considered possible to obtain reliable readings on the Bjerrum screen and perimeter in the West African patients, most of whom were followed up during their convalescence for considerable periods. Where examination of the cerebro-spinal fluid was done, it showed such a high cell count that it seemed probable that the normal C.S.F. cell content in West Africans is higher than in

Europeans. If the intra-ocular changes were those of a true optic neuritis caused by typhus, it is considered most unlikely that in the series only two cases should show definite deterioration in visual acuity and contraction of fields, in view of the number of cases which showed sign of active papillary involvement during the acute stage of the disease and although ten showed a typical text-book picture of optic neuritis in its early stage. The interpretation placed on the ocular signs is that of a vascular upset and not a neural or neuroglial involvement by invasion of the nerve tissues by the rickettsial bodies. There appears to be only very slight local reaction to the organism which would explain the absence of post-neuritic changes due to fibrosis of the optic nerve and retina. It is not understood why toxic substances which have done so much harm to renal and hepatic tissues should allow the more delicate cells of the brain and retina to escape obvious permanent damage. It is to be remarked that in almost every case which showed systemic complications, there were also very obvious intra-ocular changes.

The use of the term hyperaemia was avoided unless the disc colour was very markedly outside the normal physiological limit. The positive errors in determining the amount of variation to be called physiological were greatly increased by the diversity of pigmentation of the fundi in the mixture of European, West African and Indian patients seen during the course of the day's work while the survey was being carried out. Similarly marginal blurring was not noted as pathological unless two or more quadrants of the disc were involved.

Summary

A series of 101 cases of tropical typhus have been examined. It has been found that many showed signs of the "descending neuritis" as described by von Graefe, and that the signs disappeared without any residual damage to the optic nerve or retina.

Acknowledgment. I wish to record my gratitude to Lt.-Col. Card, R.A.M.C., Major Rodger, R.A.M.C. and Capt. Hunt, R.A.M.C., for their kind help and the use of case notes and to Capt. Howrie for his kind help in the compilation of the table.

TYPES, PAPER AND PRINTING IN RELATION TO EYESTRAIN

BY

R. B. FISHENDEN

COMFORT in reading is as important to those concerned in producing books as to the ophthalmic surgeon. Considerable work has been done on the subject by workers who have approached the subject scientifically and by those who have made type legibility a special study. Unfortunately these investigations do not appear to have been correlated, even in recent times, although instruments have been devised to measure complex "reader reactions": there are many diverse factors to be taken into account and these may lead to inaccurate conclusions if the approach is not sound.

In considering briefly some points of interest a few assumptions will be made. Illumination will be on the basis of bright diffused daylight or artificial illumination, say twenty foot-candles. The papers used are either white or lightly tinted, and the printing done in black ink.

In an early investigation on types for school books[1] sound conclusions were reached. The report was against condensed types, or narrow breadth being more important than height. It was recognised that contrast between fine and heavy strokes should be avoided. De Vinne, referring to this subject, said that "the punch cutter straining after a hair line that just stops before invisibility is ably seconded by the pressman who scantily inks these light faces."

Apart from dimensions of the letters, fine hair lines are likely to approach the visual threshold, as are serifs—although these, if well designed, are an aid to differences in letter forms and thus to legibility. It is evident that types which do not exhibit an extreme of contrast between thick and thin strokes will be more restful. The difference between these two groups of type design is here illustrated.

In every period there have b

In every period there have been

FIG. 1.

The first example shows normal contrast between thick and thin lines. the second excessive contrast. The second shows the thick lines arranged vertically, while the first shows them at an angle which aids the flow of easy reading.

Well designed sans serif types have their value, as is demonstrated in the Edward Johnston poster type for London Underground and Gill Sans by Eric Gill.

An early investigator, Legros,[2] showed that there is a greater coincidence between the characters in the alphabets of some type forms. This is of more importance in figures than in letters; differences between two designs of figures are shown.

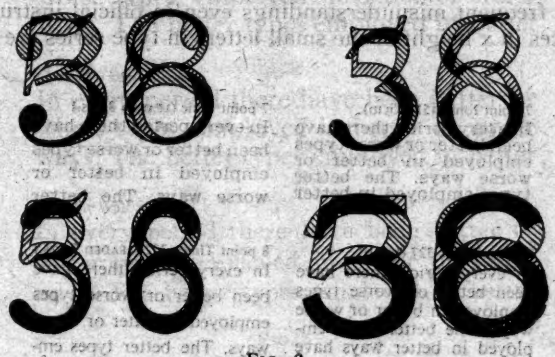

FIG. 2.

It is sometimes considered that legibility is aided, particularly in figures, by maximum differences. The diagram shows four series, the the solid black showing the co-incidences. From this aspect the first is the best and the last the least successful.

In the design of types there should be no serious departure from accustomed shapes. The types for timetables have been specially studied and figures designed to provide maximum differences in outline without departing from the recognised forms. The legibility of both figures and letters is dealt with in a report on Government Printing,[3] which advised that " types in

RIPPLE ROAD (Lodge Avenue)	4	52	5	12	5	32	5	42	5	52	6	12	6	32	6	52	7	12
RIPPLE ROAD (Barking P.O.)	4	56	5	16	5	36	5	46	5	56	6	16	6	36	6	56	7	16
EAST HAM (Town Hall)	5	01	5	20	5	40	5	50	6	00	6	20	6	40	7	00	7	20
GRAYS (Queens Hotel)	6	20	6	40	7	00	7	25	7	40	8	00	8	20	8	40	9	00
PURFLEET	6	35	6	55	7	15	7	35	7	55	8	15	8	35	8	55	9	15

FIG. 3.

Time table figures are specially designed for maximum legibility. This example is regarded as one of the most successful.

which the contrast between the thick and thin strokes is exaggerated, or in which the face is unduly compressed, should not be used." A section of timetable figures of London Transport is here shown.

Apart from configuration, the major factor in type legibility is size. Types nowadays are known by their point size, there being seventy-two points to the inch. This article is set in 11 point old style type and the heading in antique old style, a heavy type of similar character. It is usually considered sufficient to a type in which the metal is one-sixth of an inch in depth. Legibility depends on the size of the small or lower case letters, known as "x" height, and although this is well understood there are frequent misunderstandings even in official instructions. Differences in x height of the small letters in type series are shown

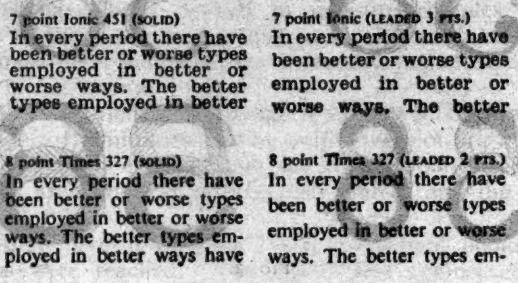
7 point Ionic 451 (SOLID)
In every period there have been better or worse types employed in better or worse ways. The better types employed in better
7 point Ionic (LEADED 3 PTS.)
In every period there have been better or worse types employed in better or worse ways. The better
8 point Times 327 (SOLID)
In every period there have been better or worse types employed in better or worse ways. The better types employed in better ways have
8 point Times 327 (LEADED 2 PTS.)
In every period there have been better or worse types employed in better or worse ways. The better types em-

FIG. 4.

Examples on the left with the types unleaded show that the size is not related to the size of face, the smaller 7-point "Ionic" being larger than the 8-point "Times." On the right the two types have leads between the lines which markedly increases legibility.

in the following examples on the left; although "Ionic" is on a smaller body, the face is larger than "Times."

Legibility will be reduced if the letters of words are packed too closely. The spacing between words is also important; if too close, reading is made more difficult and if too wide the appearance of the page is not so good.

The reading reactions to wide spacing between lines have been measured. Legibility is improved by inserting a space between the lines of type, called "leading," and it is a corrective for too long lines (see examples above on the right). Increased leading naturally increases the number of pages. The length of line requires to be related to the type size.

There are notable differences in legibility in the design of types, a subject which has been discussed by Morison,[4] Warde,[5] Tarr[6] and others.

Times Roman is a successful modern type whose legibility is shown to advantage in small advertisements.

10 point Fournier 185 (SOLID)

In every period there have been better or worse types, employed in better or worse ways. The better types employed in better ways have been used by the educated printer acquainted with standards and history, directed

12 point Baskerville 169

In every period there have been better or worse types, employed in better or worse ways. The better types employed in better

12 point Times 327

In every period there have been better or worse types, employed in better or worse ways. The better types employed in better

12 point Walbaum 374

In every period there have been better or worse types, employed in better or worse ways. The better types employed in better

FIG. 5.

These are four types, all of good design, widely used. Baskerville is a popular type for books, also Fournier and Walbaum. "Times" may be the best type for newspaper printing, and is now widely used for a variety of purposes.

SITTING ROOM, BED ROOM, use of bath room, in lady's well furnished flat, modern block; central heating, 'phone. To let to sole paying guest.—Write Box O.98724, The Times, E.C.4.

TWO large first-floor Unfurnished ROOMS in lady's well appointed house near Kensington Gardens, W.8; lift; facilities cooking; some service by arrangement; 3-4 gns. weekly.—Box 864, Brown's Advtg. Agency, S.W.1.

FIG. 6.

Small advertisements in newspapers are an extreme test for legibility. These two advertisements are set in "Times" and show unusual clarity.

Visual acuity is stated to be in the order of one minute of arc in resolving two adjacent black lines. In an illustration by the half-tone process of coarse screen, as for example a newspaper half-tone or a half-tone poster, the angle at which the dots fail to be resolved is less than half a minute.[7] Experiment shows there is a sharp end point in the visual reaction when the individual half-tone dots cannot be resolved.[8]

The design of type for book work embraces aesthetic consideration as well as the more mundane aspects of visibility, and this

has sometimes been overlooked in investigations.[9] A well designed book type assists the eye to flow along the line and there is a marked psychological difference between such a type and one which has the effect of halting the eye at each word, although the type may be legible. A happy example of a good type of this kind is here shown in contrast with a poor one. Idiosyncrasies in, or unfamiliar forms of letters interrupt smooth reading.

The influence of paper on appearance, legibility and the reader's comfort needs consideration. Smoothness, relative hardness of the surface, opacity, coating and gloss, are the chief factors. To ensure that a type shall print with clarity, a smooth

12 point Mediaeval 136

In every period there have been better or worse types, employed in better or worse ways. The better types employed in better

14 point Bembo 270

In every period there have been better or worse types, employed in better or worse ways. The better types employed in better

FIG. 7.

The second example, "Bembo," has some similarity to the first example in Fig. 1. The type is well proportioned and the long descending characters are helpful and in contrast with the example of "Times" in Fig. 5. The absence of disturbing elements and the oblique stress help easy reading. "Mediaeval" is a bad type from the standpoint of legibility; the unusual shape of some of the letters causes the eye sub-consciously to halt.

paper, white or off-white, is preferred. A rough paper known as an "antique" or a "featherweight," sometimes used by publishers to give novels a deceptive bulk, needs more ink and pressure on the printing machine. The first effect of this rough paper is that the extra pressure and ink cause the types to print more heavily than smooth ones.

In the early days of printing damped paper was used, which enabled results to be produced with less pressure than would be necessary on a dry paper. In these conditions the types printed more heavily and it is important to remember that the types were designed for this kind of treatment; if these types are printed on a smooth paper they tend to give a spidery appearance.

One of the drawbacks of the heavy inking and pressure necessary for printing dry "antique" paper is that with small types, and even book types, there is a tendency for the type to fill in; this applies particularly in such letters as the loop of the small

"e" and some types are designed to reduce this tendency to a minimum. Line illustrations, particularly those with fine detail, print better on a smooth paper.

Apart from the smoothness of a paper surface, a relatively hard one—the hardness depending on the fibres used and on the sizing—needs more pressure on the printing machine than does a soft one: a nice balance is required between the right fibre, the sizing and the surface, to ensure good printing and minimum trouble for the printer. If the right paper is chosen, half-tone illustrations with a medium fine screen, say 120 lines to the inch, can be printed adequately, and in some cases a finer screen may be used; a good example of a paper of this kind was used in the *British Journal of Ophthalmology* prior to the war.

With the introduction of paper restrictions and the need for the greatest economy, papers of light substance have been used for book work and in some cases these have lacked the required opacity. Opacity and substance are not directly related because the treatment of the fibres in making the paper has some influence, and it is also possible to add loading material to suitable papers to increase opacity. When using a paper of low opacity eyestrain may be induced because the ink on the reverse side, and also on the next sheet, becomes apparent. This effect is known as "show through." In papers of this class the nature of the ink should be arranged so that the medium, or liquid part of the ink, does not penetrate the paper unduly. Where the ink is defective in this respect the effect is bad and the phenomenon is known as "strike through." Papers used for printing Bibles are of thin substance but they have a relatively high opacity.

Art paper comprises a body paper coated with china clay, usually bound in casein, and the paper is calendered to give it a high gloss. Papers of this kind were evolved to render adequately the detail in blocks made by the half-tone process. On uncoated papers the individual dots may be in some measure distorted, which causes the details to be poorly rendered. Such is the justification for using art papers, and they give the maximum contrast between the blackness of the ink and the whiteness of the paper coating. Apart from these technical considerations, glossy coated papers are best avoided because they are tiring for the reader.

A smooth uncoated paper has a good diffuse reflection so that whatever the angle of incidence of the light may be, there is little or no glare. Owing to its high gloss, the art paper has a high specular reflection and the tiring glare accompanying these papers will be recognised. Papers free from glare which would print half-tone blocks reasonably well were available before the war and it is felt that these papers have value on technical, physiological and aesthetic grounds.

Given a type of high legibility, and paper of a suitable kind, the quality of the printing has a marked influence on the effect of the printed pages and on the readability. Uneven and bad inking induces eye-strain. The printability of the paper and the care exercised by the printer have a marked effect on the clarity of illustrations.[10]

These brief notes on paper refer to letterpress printing and the subject requires study in different ways when the lithographic offset and photogravure processes are used.

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OPHTHALMIC TREATMENT IN THE FIELD, 1943*

BY

G. C. DANSEY-BROWNING, Major, R.A.M.C.

"The CYCLOPS, a people of Sicily . . . ." *The Odyssey*

THE object of this article is to make a report on the present medical state of the ophthalmic battle-casualties from the Sicily and early Italian campaigns. My reason is the remark heard a long time ago of a cynic who left the operating theatre muttering "Very neat, but I would like to see that eye in two years time!"

The mobile ophthalmic unit

The conditions under which the unit worked were scarcely orthodox. Let me attempt to set the scene for you!

Take a case of instruments, a packful of test-types, loupes, the ophthalmoscope, and grab the first hospital-ship available. Your last-minute choice of essentials are flung at your orderly, together with the spare pair of shorts and shirt that will constitute all your "others" for the next three months.

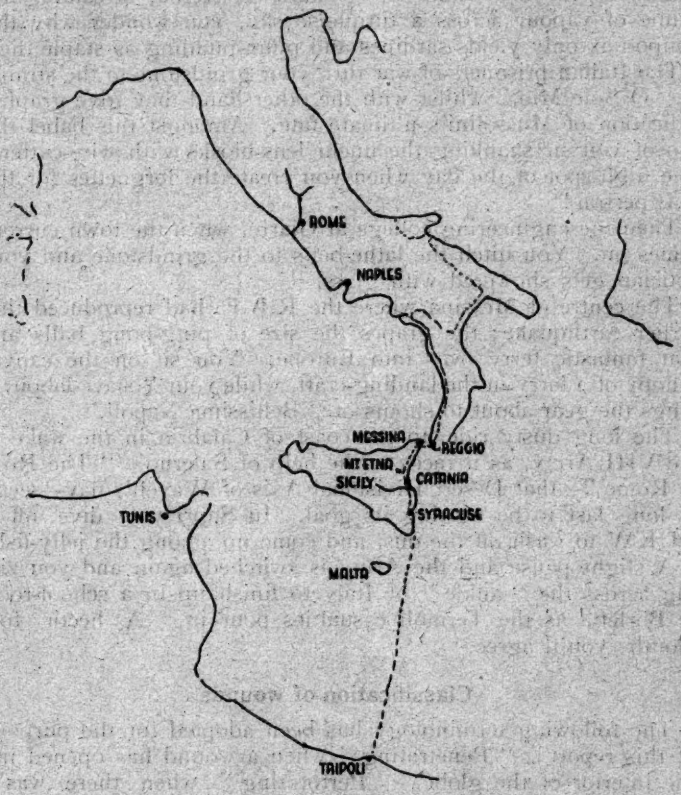
Berth in Syracuse harbour for a hair-raising spell between a

* Received for publication, August 28, 1945.

sunken hospital-ship and a burning oil-barge. Then disembark and hitch-hike to the medical area. This is of course in the local lunatic asylum; all the inmates are still *in situ*! Next morning you find that you are next to the famous quarries; where the Athenian shades in that earlier Belsen must often have shuddered at your school-boy translations.

Anyhow once more you are at the evacuation bottle-neck; to work and travel forward with the field surgical units. Soon the

SKETCH MAP



Legend

.....The travels of the Ophthalmic Unit during the four months under review.

facio-maxillary and neuro-surgical units will catch up and the "Trinity" of the old desert days is reconstituted.

Everywhere there are the elements of comic opera.

Leaning over the Municipio balcony at Lentini, you are greeted by loud "Vivas" from the town band dressed as Italian admirals. Forthwith they burst into spirited versions of the complete and unabridged anthems of all the United Nations both great and small. Oh! the sheer joy and relief when you lower your arm from that salute!

Gradually you acquire more equipment and drugs; operate and treat the cases from the malarial plain before Catania. As you move forward under the shadow of Aetna, streaming its plume of vapour across a turquoise sky, you wonder why the compo-box only yields sardines and plum-pudding as staple diet.

The Italian prisoners-of-war turn your grindstone to the strains of "O Sole Mio," whilst with the other hand they give graphic indication of Mussolini's ultimate fate. Amongst this babel the two of you sit shanking the uncut lens-blocks with wire-cutters. The high-spot of the day when you create the lorgnettes for the V.I. person!

Then the engineering college at Giarre, when the town current comes on. You hitch the lathe-belts to the grindstone and your optician gets showered with glass.

The centre of Messina where the R.A.F. had reproduced that earlier earthquake; the grapes the size of ping-pong balls and that fantastic ferry over into Europe. You sit on the canvas canopy of a lorry in the landing-craft, while your "slave-labour" flings the gear about to shouts of "Bellissima Napoli."

The long dusty ride up the coast of Calabria in the wake of the VIII Army, as it races to the help of Salerno. "The Road to Rome"—that Desert Divisional Axis of Wavell's day—seems at long last to be nearing its goal. In Sapri you dive off a DUKW to wash off the dust and come up among the jelly-fish!

A slight pause and the Army is switched again and you zig-zag across the "ankle" of Italy to finish up in a school-room at Barletta as the Termoli casualties pour in. A hectic four months you'll agree.

Classification of wounds

The following terminology has been adopted for the purposes of this report: "Penetrating" when a wound has opened into the interior of the globe. "Perforating" when there was a through and through wound of the globe. This is in contra-distinction to the "double perforating," "perforating," etc., of Würdemann. The wounds have been arranged under the head-ings of the missiles, etc., that caused them (Table 1).

TABLE I

INJURY	NATURE OF MISSILE								
	Shell	Mortar	Landmine	Booby-trap (Accident)	Bullet	Hand-Grenade	Bomb	Air-Cannon	Totals
Intra Ocular F.B.									
Corneal Wd.	2	2	2	2	2	—	—	1	11
Limbal Wd.	—	—	1	1	—	—	—	—	2
Scleral Wd.	4	3	—	—	2	2	—	—	11
Perf. Orbital F.B.									
Corneal Wd.	1	—	—	—	—	—	—	—	1
Scleral Wd.	—	1	—	—	1	—	—	—	2
Non-Penetrating Orbital F.B....	3	2	—	—	—	1	—	—	6
Corneal, Scleral, Conjunctival F.B.'s	7	4	10	1	—	—	2	1	25
Occipital F.B.'s	1	—	—	—	—	—	—	—	1
Disorganised Globe	7	7	2	3	2	1	—	—	22
Injury Lids and Adnexa ...	2	1	—	—	1	—	3	1	8
Traum. Keratitis	2	2	—	—	—	—	—	—	4
C. Abrasion, Hyphaema ...	6	1	1	—	—	1	—	—	9
Lens Injury	1	—	—	—	—	—	—	—	1
Vitreous Haem.	5	3	—	1	—	—	1	—	10
Detachment Retina	1	—	—	—	—	—	—	—	1
Commotio Retinae Traumatic Mydrias.	2	1	—	—	—	—	—	—	3
Optic Atrophy	1	—	—	—	—	—	—	—	1
Ocular Muscle Palsy	1	—	—	—	—	—	—	—	1
Rupture Choroid	—	1	—	—	—	—	—	—	1
,, Cornea...	—	2	2	1	—	—	—	—	5
,, Limbus	1	3	3	1	—	2	—	—	10
,, Sclera	2	2	2	1	—	—	1	—	8
Functional Amblyopia ...	2	2	1	—	—	—	—	—	5
Totals	51	37	24	11	8	7	7	3	148

The lesion reported was the most grave noted at the preliminary examination in the field unit, and the further complications are indicated in the notes below.

Wounds in general

As in the Libyan campaigns the shell-wound was found to be most common. The next commonest was the mortar wound. However the mortar was replaced in the later Italian campaign by the land-mine, which, in Libya, had been second commonest. This was bound to happen when the Army ran up against long prepared defences. Proportionately the bullet and the land-mine were the most destructive to the eye.

The number of men wounded was small—being 129 with 148 eyes involved. Including the men who died from other wounds, a total of 39 eyes were lost. Of those lost, some 22 were noted at first examination as hopelessly disorganised. Three of the cases have finished up under the care of St. Dunstan's.

The ophthalmic casualties once more would appear to have been about 2½ per cent. of the total. This corresponds to the figures for the Russian casualties in the last war. From British experience it would seem that the American estimate of 12 per cent. (17 per cent. if gas be used) for the Pacific is rather high.

The figures for the 1914-1918 war gave 6 per cent. only of the ophthalmic injuries as due to indirect violence. Cases of this nature in the Libyan campaigns were roughly 50 per cent.; while in this series some 62 showed wounds of this nature, *i.e.*, 43 per cent.

It will be noted that in the analysis of the cases only "non-magnetic" fragments have been reported. Unfortunately the descriptions received of cases were not sufficiently full enough and by no means all F.Bs. removed from or with globes were tested against the giant-magnet. From my own impressions and previous experience I feel that the usual proportion for German missiles was that 30 per cent. were magnetic.

Again with the cruder Japanese missile the magnetic I.O.F.B. may well be more common. Loewenstein's statement that in civilian practice the I.O.F.B. is 90 per cent. magnetic and in military practice about 90 per cent. non-magnetic is thought to be too sweeping.

Analysis of cases

1. INTRA-OCULAR FOREIGN BODIES (24).

(*a*) *Corneal wound of entry* (11).—Eight of these had uveal prolapse, necessitating abscission of the prolapsed matter, complete conjunctival hood, purse-string suture, and instillation of either sulphacetamide or penicillin.

Two cases showed an early panophthalmitis at first examination, and though one thousand units of penicillin were instilled into the anterior chambers, both the eyes were lost. Recent work would show that this dosage was inadequate.

Two fragments were subsequently reported as magnetic-negative, and one of these eyes later flared up and was lost.

Two cases had had their prolapses cut off by a " general " surgeon whilst doing his routine toilet of other wounds, but unfortunately were not given a conjunctival hood. Abscission of the now recurrent prolapses, hood, etc., enabled one of the two eyes to be saved. Of two globes subsequently enucleated, one was removed five months later but no reason was obtainable from the records.

The final report received on three other cases was " quiet eye "; " healed but weak wound " and " F.B. in the lens, eye quiet."

(*b*) *Limbal wound of entry* (2).—Both of these cases required the routine abscission, hood, etc.

One report was " magnet-negative foreign body—eye quiet," whilst the other whose anterior chamber was full of lens matter has been untraced.

(*c*) *Scleral wound of entry* (11).—Seven of these wounds were of temporal entry. It is thought that these would *all* have been " preventable " by the wearing of a " coal-scuttle " type of helmet. There was only one wound of inferior entry.

Three of the wounds were self-sealed, being caused by minute fragments. Eight of the wounds necessitated the insertion of scleral sutures, and then the abscission of the prolapsed vitreous. The wound was further reinforced by drawing over the conjunctiva as a hood.

Very large fragments were lying half in and half out of two of the globes. They had to be " eased-out " between the tightening sutures. One of these eyes was removed soon after arrival at the base-hospital. The other was retained for two months before being enucleated for " recurrent hyphaema." One of these two F.Bs. was magnet-negative. Two fragments lodged in the lens and one large one directly behind it. Though all three eyes have been retained the men's present M.O.'s report that the eyes are for all practical purposes blind.

Two other of the I.O.F.Bs. were reported as magnet-negative. One very small I.O.F.B. gave a resultant vision of 6/6 and the others were " 6/24," " cataract " and " quiet eye."

2. PERFORATING ORBITAL FOREIGN BODIES (3).

In one case the exit wound involved the macular area, and the final vision was " counts fingers at 3 feet." In another the lens was driven backwards and the eye was lost; the third man died of his other wounds.

3. NON-PENETRATING ORBITAL FOREIGN BODIES (6).

Two eyes which were markedly proptosed at first examination, gave final vision of " 6/9 with pigment rings on the lens."

One fragment lodging in the roof of the orbit, with 6/18 vision and a hyphaema at first examination gave final vision of 6/6. Another penetrating through the upper lid gave only a small hyphaema and no final defect.

One incipient orbital cellulitis recovered quickly on oral sulphonamide therapy. One patient died of wounds when a fragment penetrated through the vertex, orbital roof and lodged in the orbital fat without touching the globe.

4. CORNEAL (ETC.) FOREIGN BODIES.

These small metallic fragments were left to extrude themselves after the application of sulphonamide ointment or penicillin and sulphanilamide powder. This treatment would appear to give excellent visual end-results. A similar routine was applied to all wounds that did not require immediate operation in the field unit.

5. FRAGMENT IN THE OCCIPUT.

The F.B. lodged in the dura, just over the posterior pole of the left occipital lobe, whilst bone fragments were depressed over the pole of the right lobe. On examination just prior to operation by Major L. S. Rogers, there was apparently a complete amaurosis. There was no sparing of the maculae and no pupillary response to light. Removal of the F.B. and elevation of the bone resulted in the pupils reacting to light soon after the patient came out of the anaesthetic. Confrontation showed that within 48 hours the sole residual effect was a small peripheral scotoma in the inferior-temporal field of the left eye. He was reported as discharged to duty in December, 1943, with " normal vision."

6. DISORGANISED GLOBES (22).

Associated with the majority of these were grave maxillo-facial wounds; six required repeated plastic procedures afterwards. Compound fracture of the superior maxillae was present in three of the cases; of the zygoma in two cases. One case had sustained total destruction of the bridge of the nose and another a fracture of the temporal bone. In one wound the missile passed through both temporal regions and though a pneumococcal meningitis developed the patient survived. One fragment passed directly backwards into the bulb and the patient died after 72 hours hyperpyrexia.

An early report on associated lid wounds received was that penicillin had made them " remarkably clean."

With one case the frontal lobes of the brain had prolapsed

through the wound of the eyebrow and in another they were found to be lying in the orbit when the time came to remove the remains of the eye.

7. TRAUMATIC KERATITIS.

Three of the cases slowly resolved to give a final vision of 6/6, whilst another of these gave only 6/18. In more recent fighting I understand another effect of indirect violence is to give a transient myopia of relatively high value (-9.D.) (Stallard).

8. LENS INJURY.

The case recorded was one of pure concussional effect giving a posterior cortical cataract and an iridodialysis.

9. VITREOUS HAEMORRHAGES (10).

Grave damage to the sentient portions of the globe was often veiled by these haemorrhages. Thus in three cases which appeared to have a vision of 6/24 with the haemorrhage, later there was demonstrated the presence of choroidal tears. Luckily two of the tears were peripheral giving a central vision of 6/6, but the third involved the macular area.

Stones had been blown by the force of explosions into the conjunctival fornices, in three cases, but the vitreous haemorrhages were small and quickly resolved. Although the force that carried a fragment into the frontal sinus through the trochlear fossa, gave a vitreous haemorrhage, yet the final vision was 6/6.

10. DETACHMENT OF RETINA (1).

This eye sustained a temporal scleral injury. Vision at first examination was 6/18 and the X-ray was negative for I.O.F.B. This was operated upon at 15.S. Gen. Hospital in Egypt. The man is now serving in Canada with 6/6 vision and "peripheral retinopathy."

11. LID WOUNDS (8).

As might be expected three of these were associated with destruction of the lacrymal apparatus and had peripheral concussion changes of the retina.

12. "RUPTURES OF" (19).

(*a*) Corneal ruptures (5). All these had a poor prognosis; two requiring enucleation at the base hospital in spite of attempted repair in the field unit.

The final reports on two cases with prolapse of the lens which underwent "abscission" was "quiet."

On examination of the last case a maggot crawled slowly out of the anterior chamber through the corneal wound! The eye is

still " in " but St. Dunstan's report " Total leucoma and disorganisation of the globe."

(*b*) Limbal ruptures (8). When first examined one of these showed an early panophthalmitis. Another with " F.B. in the posterior sclera " and lens prolapse was enucleated three months later as a painful eye.

Two cases are reported as " quiet " : the first with no anterior chamber and the second with a traumatic cataract noted when first seen.

One case with anterior synechia, after iridotomy has 6/6 vision, and another report was " leucoma, localised cataract and iridodialysis."

(*c*) Scleral ruptures (8). Six of these had temporal wounds—again " preventable " by a " coal-scuttle " helmet.

Seven required the insertion of scleral sutures, and abscission of prolapsed vitreous. Of these three eyes were lost and one man died of other wounds.

The final state of the others was " white eye, quiet " (this eye required four sutures), " P.L.(2) " and " No P.L."

13. RESULTS OF TREATMENTS.

The best results would seem to have been achieved in the use of penicillin and sulphonamides locally—combined with oral administration of sulphanilamide. Thus in the " abscission "; after the prolapse was removed, 500 units of penicillin in sulphanilamide powder were instilled before the purse-string suture closed the conjunctival hood. Then 2½ per cent. albucid or 5 per cent. sulphanilamide ointment was inserted between the lids. The eye was finally covered by a dressing of sulpha-vaseline tulle-gras before the pad and bandage were applied.

Conclusions

(1) A man who sustains a major wound of the eye is rarely fit enough for front-line duty again; although the numbers of eyes saved by prompt treatment and early operations are a considerable advance on the last war. In this the findings of the Sicilian fighting parallel those of the Libyan campaigns.

(2) A policy of minimal interference during evacuation and the use of penicillin and the sulphonamides locally has considerably cut down the amount of " hospital infection."

(3) The need for a " coal-scuttle " type of steel helmet it is felt cannot be too strongly emphasised.

Summary

1. An analysis has been made of the 129 ophthalmic casualties treated in a Mobile Ophthalmic Unit in Sicily and Southern Italy campaigns.

2. The types of wounds encountered and their treatment in the field have been outlined.

3. The results of such treatment and the final visual capabilities of the eyes treated, some two years later have been indicated.

My apologies are due to the many service departments, English, Canadian and American, that I have "badgered" for case records during the past six months.

My thanks are especially due to Sgt. F. Hales and Pte. R. Merrett, R.A.M.C., without whose drive and above all cheerfulness we might never have done the job, even with the help of our innumerable "tonios."

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CAVERNOUS HAEMANGIOMA OF THE ORBIT SUCCESSFULLY REMOVED BY SHUGRUE'S OPERATION*

BY

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THE removal of a retrobulbar intra-orbital tumour is a rare event, which is worthy of record in view of the dangers of injury to the delicate intra-orbital structures. In the recorded cases of successful removal of intra-orbital cavernous haemangiomata, the tumour has been well encapsulated, a factor greatly facilitating the operative procedure. It is also remarkable that there have been no supplying blood vessels of sufficient size to cause appreciable haemorrhage after the enucleation of the tumour.

A retrobulbar intra-orbital tumour could only be exposed through one of the bony walls of the orbit, and although every route has been exploited, the two most commonly used routes are through the roof of the orbit or through its outer wall. The approach through the roof of the orbit is necessarily an intra-cranial approach, and although the dura mater could be reflected off the bone if there were no intra-cranial extension, it is generally agreed that this route should be reserved for cases in which there

* Received for publication, June 2, 1945.

has been an extension of the growth through the roof of the orbit. The best known method of approach through the outer wall of the orbit is the Krönlein operation. It is difficult to see how the branches of the facial nerve to the muscles of the eyelids could escape injury when the skin incisions are made, although recorded cases make no mention of paralysis of the orbicularis oculi muscles after the operation. The Shugrue operation (Spaeth, 1939) definitely conserves the branches of the facial nerve supplying the eyelids, and this was felt to outweigh the disadvantage of permanent removal of the outer wall of the orbit entailed in this operation :—

Case Report :—D.M.S. male, Cingalese, aged 52 years, entered the General Hospital, Colombo, on December 11, 1944, on account of gross protrusion of the left eyeball. Eighteen months previously the patient had noted that the vision of his left eye was failing, but he had put this down to advancing age. During the last six months, the left eyeball had begun to protrude, and this had steadily become so much worse that he had been unable to close the lids over the eyeball.

On examination the patient was seen to be an elderly Cingalese labourer, who presented a striking picture from the circumstance

FIG. 1.

X-ray of patient's skull, showing absence of involvement of bone by the tumour.

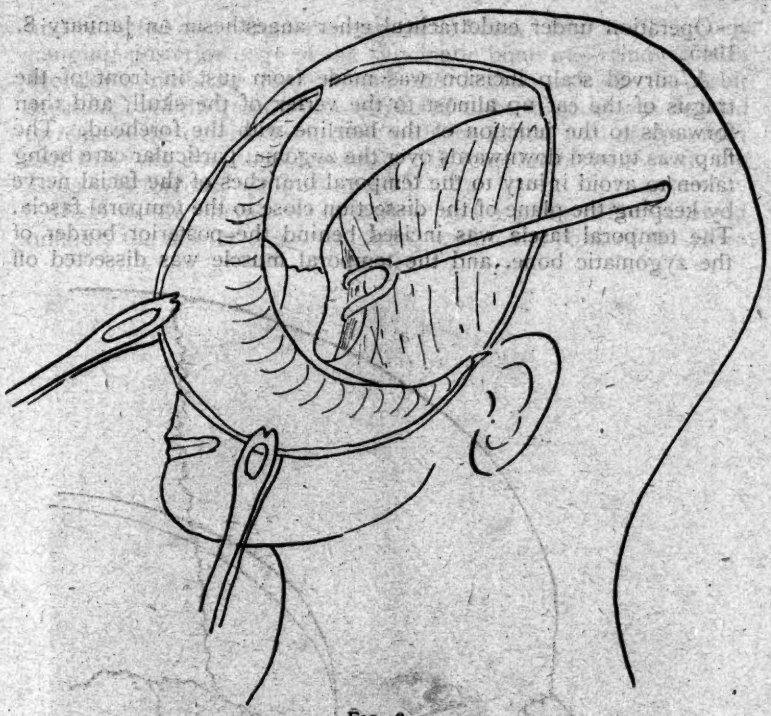

FIG. 2.

Shows exposure of zygomatic bone by Shugrue's operation.

that the left eyeball was almost protruded out of its socket. The ocular conjunctiva was injected, and there was epiphora. There was a cataract in the left eye and the patient was only able to distinguish objects at six inches from this eye. Vision in the right eye was good. The movements of both eyes were normal but there was some limitation of the movements of the left eyeball at its extreme peripheral excursions. The case was referred to Dr. Dadhaboy, Senior Ophthalmic Surgeon of the Ceylon Medical Service who reported as follows:—Incipient cataract in left eye. Fundus and disc normal. Right eye vision 6/12. Left eye vision 3/60. The rest of the report covered the points already elaborated. Dr. Dadhaboy was of opinion that the poor vision of the left eye was due to the cataract. It was clear that the patient had a retrobulbar intra-orbital tumour which had not infiltrated the extra ocular muscles. The Wassermann and Khan reactions were negative. An X-ray picture showed no evidence of involvement of the cranial bones by the growth and the air sinuses were normal. Fig. 1.

Operation under endotracheal ether anaesthesia on January 8, 1945.

A curved scalp incision was made from just in front of the tragus of the ear up almost to the vertex of the skull, and then forwards to the junction of the hairline with the forehead. The flap was turned downwards over the zygoma, particular care being taken to avoid injury to the temporal branches of the facial nerve by keeping the plane of the dissection close to the temporal fascia. The temporal fascia was incised behind the posterior border of the zygomatic bone, and the temporal muscle was dissected off

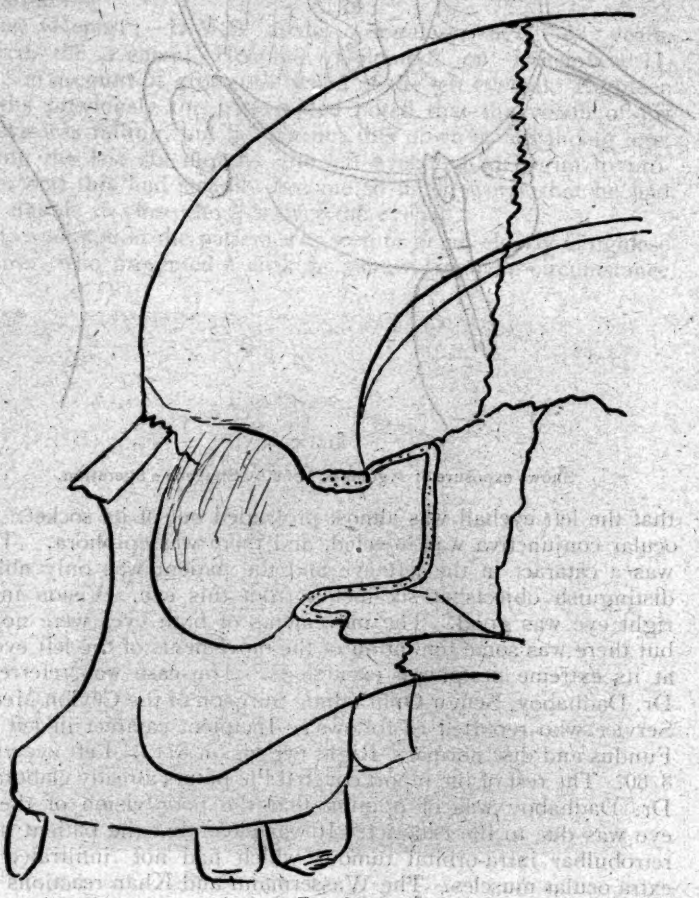

FIG. 3.

Diagram of patient after operation showing extent of bone removed in Shugrue's operation.

and retracted away from the zygomatic bone. Fig. 2. The overhanging posterior edge of the zygomatic bone was removed with Horsley's nibbling forceps and the lateral wall of the orbit exposed. As the tumour was expected to be large, it was decided to remove the outer rim together with the lateral wall of the orbit, and this was done by continuing the removal of bone with the Horsley's forceps. (Fig. 3 and 4.)

Deep to the lateral rectus muscle was a plum coloured ovoid tumour, the size of a marble, lying within the cone of the extra

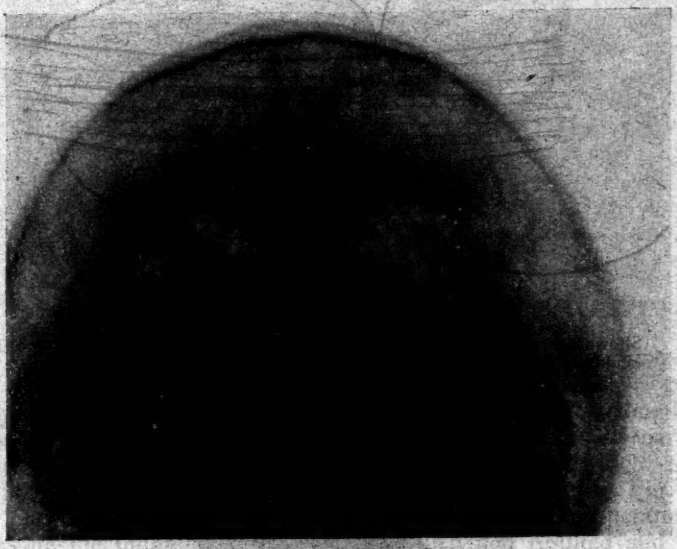

FIG. 4.

Shows extent of bone removed in Shugrue's operation

ocular muscles with its anterior pole resting on the posterior pole of the eyeball, Fig. 5. The connective tissues between the superior rectus and the lateral rectus muscles were gently separated, and the tumour was enucleated from its bed by careful blunt dissection with the blades of an artery forceps. The tumour shelled out readily (Fig. 6) and there was surprisingly little haemorrhage from its bed. The incision in the temporal fascia was sutured and the skin wound was closed. The old man stood the operation well, and the proptosis was now no longer present. Some hours after operation there was marked chemosis, which gradually subsided in the next few days. At this time it was noted that outward movement of the left eyeball only occurred up to the neutral

position and that there was some ptosis of the upper eye-lid which was not however sufficient to cover the pupil even on looking upwards. Dr. Dadhaboy reported that vision was the same as before the operation, and advised that the patient be referred to him at a later date for the cataract operation.

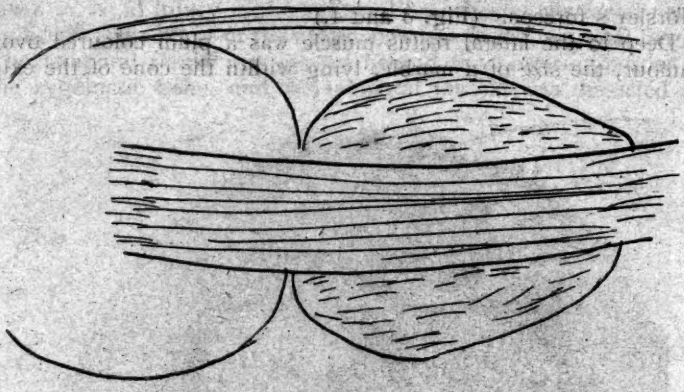

FIG. 5.

Shows operation view of the tumour, with its relations to the extra-ocular muscles.

FIG. 6.

Photograph of tumour. A piece of tumour has been removed to show the internal structure. Large spaces filled with blood clot are seen on the cut surface. (The tumour was photographed a month after operation, and it has shrunk considerably).

FIG. 7.

Micro-photograph showing the large blood containing spaces lined by endothelium.

Microscopic examination shows the tumour to be composed of cavernous blood containing spaces lined by a well-developed layer of endothelium. This layer of endothelium is surrounded by plain muscle fibres in the case of some of the spaces. Separating the endothelial walls is a layer of fibrous tissue which contains fat cells and well-formed blood vessels in some areas, Fig. 7.

The patient was well pleased with the result of the operation, despite the limitation in movements which had resulted and he left hospital on February 23, 1945.

Commentary.—Reference to recorded cases of successful removal of tumours through the external wall of the orbit shows that weakness of the lateral rectus muscle is a not uncommon sequel. (Crawford *et al*, 1943, Stallard, 1938.) It is possible that the weakness in this case would improve as time went on, as would also the weakness of the upward movements of the upper eyelid. The experience in this case with Shugrue's operation suggests that excision of the outer wall of the orbit does not in itself appreciably interfere with the function of the eye, nor is the deformity particularly noticeable. The exposure of the tumour was particularly good, and the risk of operative trauma to the intra-orbital structures is thereby minimised.

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"AN ANALYSIS AND FOLLOW-UP OF 301 CASES OF BATTLE CASUALTY INJURY TO THE EYES"*

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THE following account represents a follow-up of three-hundred-and-one patients with war-injury to the eyes or adnexa, 359 eyes being involved. The casualties occurred during the terminal phase of the Western Desert Campaign.

A much larger number could have been analysed if earlier cases had been included, but as accurate follow-up records were not available for many of the earlier cases, we have thought it wiser to confine our analysis to this smaller group which were followed until the men concerned were either repatriated or had returned to duty.

The cases may be classified as follows:—

1.—Primary excision (56).

Severe injury usually of indeterminate nature, in which the eye was excised within 2-3 days of the date of injury.

2.—Penetrating wounds of the eye (190).

(i) Non-perforating foreign bodies (*i.e.* F.B. coat of eye)	52
(ii) Intra-ocular F.B.	78
(iii) "Double-perforating" F.B.	20
(iv) Query (ii) or (iii)	40

3.—Contusion wound of eye (52).

Cornea	Nil
Sclera	3
Lens	1
Iris	4
Vitreous	38
Choroid	16
Retina	17

4.—Concussion injury (26).

Cornea	1	Air or tissue conducted
Sclera	1	
Lens	4	
Iris	3	
Vitreous	13	
Choroid	6	
Retina	11	

* Received for publication, August 8, 1945.

General Review.—The missiles causing the injuries were as follows:—

	Per cent.
Grenade	25·0
Shell	24·0
Gun-shot wound	11·3
Mine	9·0
Mortar	7·3
Aerial bomb	5·3
Booby-trap	3·3
Miscellaneous	7·6
Unknown	7·2

There were fifty-eight (19 per cent.) cases with bilateral injury, twenty-three of which were certifiably blind.

The relation between the nature of the missile and the distance from the explosion in 141 cases is summarised in Table I.

TABLE I

Relation between nature of missile and distance from explosion in 141 cases.

Grenades	67
Land-mine or Booby-traps	35
Shells	39

Percentages

	Within 3 yards	4–8 yards	8–20 yards	More than 20 yards
Grenade	80·5*	12	7·5	Nil
Land-mine or Booby-trap	83†	17	Nil	Nil
Shell	50	20	23	7

* 50 per cent. within one yard.
† 34 per cent. within one yard.

Relationship between nature of F.B. and severity of damage to the eye.—Gun-shot wounds, mortars, aerial bombs and shells (in order of severity) were more severely damaging to the globe than were grenades (Table III).

Time between injury and first treatment. It is not possible in all cases to state the exact time which elapsed before the patient was first seen by an ophthalmic surgeon, but the vast majority was seen within 48 hours. In only two cases was there a reported complaint of upset in the usual method of evacuation resulting in mischief to the eye. Seventy per cent. of abscissions of prolapsed iris were done within 48 hours.

Sulphonamides and penicillin. Infection was minimal whether these drugs were used or not, and the results of their use were, in any event, too uncontrolled to allow of any definite conclusions.

Sympathetic ophthalmia.—No case occurred in the cases under review.

Functional disturbances.—This was exceeding uncommon, and is a measure of the high state of morale in the Eighth army. Six cases of hysterical amblyopia were recorded in this series, two of which occurred in the remaining eye, following enucleation of the other.

Disposal.—The ultimate disposal was followed up in 249 cases:—

		Per cent.
(1)	Repatriated because of ocular condition ...	28·1
(2)	Repatriated because of general condition ...	8·4
(3)	Returned to unit...	63·4
	(In lower category, 41·7 per cent.)	
	(In same category, 21·7 per cent.)	

Of the 28·1 per cent. repatriated because of the ocular condition, one half were Indians suffering from the loss of sight of one eye.

In the case of U.K. troops the loss of an eye was not regarded as making a man unfit for service overseas unless it was associated with damage to the socket or severe super-added functional disturbance. In the absence of such complications these men returned to duty with base or L. of C. units.

Final visual acuity.—The final visual acuity was obtained in 213 cases, the results being summarised in Table II.

TABLE II

Comparison of final visual acuity in perforating, concussion, and contusion injuries to the eyes

Percentages

	Enucleation	Counting fingers or less	6/60 or 6/36	6/24 or 6/18	6/12 or better
Perforating wounds, 138 ... (I.O.F.B. or double perforating)	31	38*	13	4	14
Contusion injuries, 49 ...	4	41	6	12	37
Concussion injuries, 26 ...	—	38†	23	15	23
All injuries, 213	21	38‡	13	7	20

* In one-third of these defective vision was due to cataract.
† In one-fifth of these defective vision was due to cataract.
‡ Defective vision was due to cataract in nearly half of thes cases.

The above analysis shows that 40 per cent. of all cases of severe injury to the eye recovered useful vision, 20 per cent. having 6/12 or better. In a further 16 per cent., however, the defective vision was due solely to lens opaciiy, the eye being therefore potentially useful. The eye was rendered functionally useless in approximately 44 per cent.

Vision following perforating wounds.—Useful vision was retained in 31 per cent., and potentially useful vision in a further 13 per cent. in which the defect was due to cataractous changes, the eye being otherwise healthy.

Vision following contusion injury.—Useful vision was retained in 55 per cent.

Vision following concussion injuries.—Useful vision was retained in 61 per cent. and potentially useful vision in a further 7 per cent.

Concussion injuries were, therefore, in general, less destructive than contusion injuries, while perforating injuries were considerably more serious in their effect on function.

An analysis of 107 eyes with visual acuity of 6/60 or less showed that the causes were as follows:—

	Per cent.
Vitreous haemorrhage or opacities	60·0
Cataract	18·0
Choroido-retinal oedema, haemorrhage or tears	6·0
Detachment of the retina	4·0
Unclassified	12·0

Perforation of the globe

There were 135 patients with perforation of the globe, 138 eyes being involved.

In 40 per cent. the entrance site was in the cornea, in 28 per cent. at the limbus, in 29 per cent. in the sclera, and in 3 per cent. indefinite. The main features noted in regard to damage to the globe were the following:—

	Incidence per cent.
Severe corneal damage	6·5
Uveal prolapse	30·4
Iris hole	16·7
Iridodialysis	2·2
Retroverted iris	0·7
Lens opacity	39·8
Vitreous haemorrhage or opacity	39·1
Retinal conditions	5·1
Choroidal rupture	7·2

Nature of missile.—The grenade: shell ratio was 1:0·6; the grenade: mine or booby-trap, 1:0·4; and grenade: aerial bomb or mortar 1:0·3.

An analysis of sixty cases with positive X-ray findings of a foreign-body showed that a grenade fragment had a 40 per cent. less chance of being X-ray positive as compared with a fragment of shell.

Effect upon visual acuity.—The chief causes of poor vision, 6/60 or less, were vitreous haemorrhage (63 per cent,) and cataract (25 per cent). The final visual acuity in all cases of perforation has already been summarised in Table II.

Follow-up.—Twenty-two cases could not be followed as regards their ultimate disposal, but the disposal of the remaining 113 cases was as follows:—

	Per cent.
Repatriated because of eye condition	37·0
Repatriated because of general condition ...	8·0
Returned to duty	55·0

Of the 37 per cent. repatriated because of the eye condition, 15 per cent. were Indians with loss of vision of the affected eye, the other eye being normal.

Of the 55 per cent. who returned to duty, 48 per cent. returned in a lower category and 7 per cent. in the same category.

Intra-ocular foreign bodies

There were seventy-six patients with intra-ocular foreign bodies, seventy-eight eyes being involved. The entrance site was through the cornea in 37 per cent., the limbus in 33 per cent., the sclera in 26 per cent., and indefinite in 4 per cent.

In 65 per cent. the F.B. was posterior to the lens, and in 17 per cent. there was more than one foreign body present.

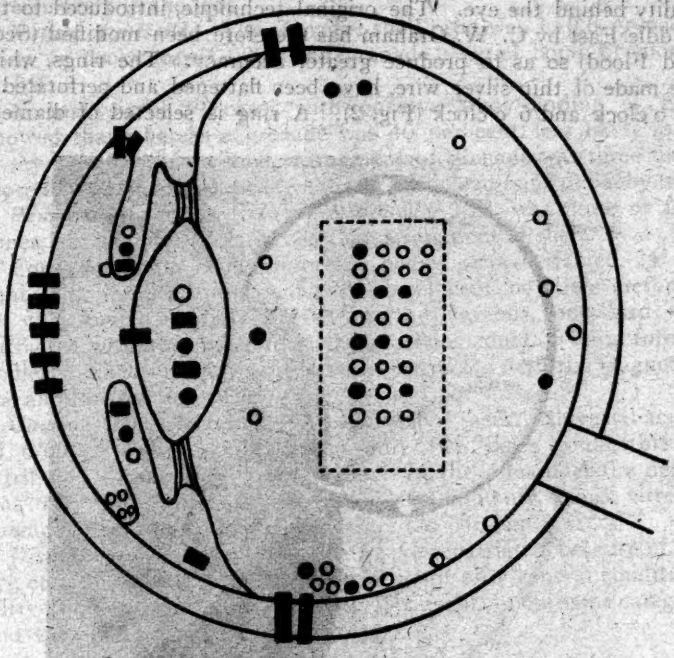
The positions of the foreign bodies, in 74 eyes, are depicted in Fig. 1.

The principal features of damage to the globe may be summarised as follows:—

	No. of cases	Per cent.		
Severe corneal damage	5	6·0		
Uveal prolapse ...	25	32·0	Iris ...	26·0
			Iris and ciliary body ...	5·0
			Ciliary body	1·0
Iris hole	11	14·0		
Iridodialysis ...	2	3·0		
Retroverted Iris ...	1	1·0		
Lens opacity ...	27	35·0		
Vitreous haemorrhage or opacity ...	25	32·0		
Choroidal rupture ...	3	2·0		
Retinal haemorrhage	3	3·0		
Commotio retinae ...	1	1·0		
Retinal detachment	1	1·0		
Retinitis proliferans	1	1·0		
Endophthalmitis ...	3	4·0		

FIG. 1.

Composite diagram showing position of 74 intra-ocular foreign bodies.



● Extracted with electro magnet.
■ Instrumental extraction (forceps, spud, etc.).
○ Not extracted.

(Foreign bodies in the vitreous placed within the dotted rectangle represent those in which the exact location was not stated, but were recorded as being in "mid-vitreous.")

The figures for choroido-retinal disturbance apply solely to those cases with visible fundi. Many such changes were undoubtedly present in the fundi that could not be seen.

Diagnosis.—In 36 cases (46 per cent.), the foreign-body was visible without X-ray examination. Of the foreign-bodies situated behind the lens, 14 (27 per cent.) were visible with the ophthalmoscope. In 50 per cent. the F.B. was not visible except by X-rays, and in 3 cases (4 per cent.) the diagnosis was only confirmed after enucleation, one piece being a fragment of bakelite measuring 12 × 5 × 5 millimetres.

The "magnet test" was not positive in any case where the X-ray was negative.

X-ray localisation.—The "limbal ring" method of localisation

(described by Stallard) proved reliable, except in 3 cases in which foreign-bodies were thought to be intra-ocular when they were in reality behind the eye. The original technique, introduced to the Middle East by C. W. Graham has therefore been modified (Scott and Flood) so as to produce greater accuracy. The rings, which are made of thin silver wire, have been flattened and perforated at 12 o'clock and 6 o'clock (Fig. 2). A ring is selected of diameter

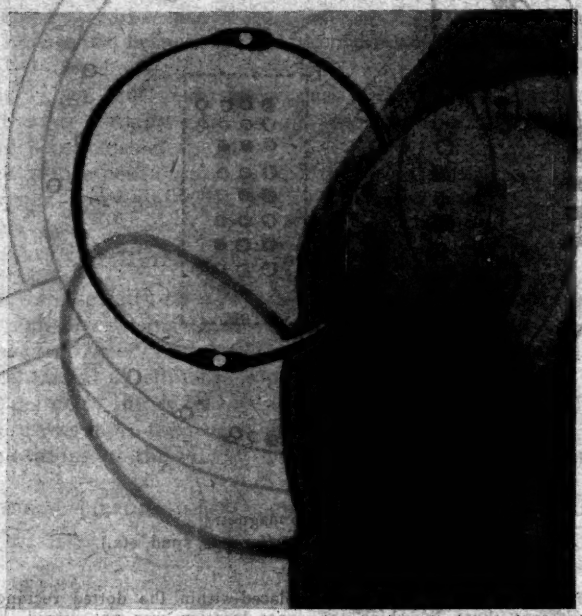


FIG. 2.

slightly wider than the cornea, and is stitched firmly to the *sclera* immediately outside the limbus, thus ensuring that the ring moves accurately with the eye. Marks are made on the sclera, at 12 and 6, with a needle dipped in Indian ink.

The movement of the foreign bodies external but close to the globe is rarely as great as that of the eye and the ring attached to it.

The radiological localisation is given in relation to the "vertical" meridian of the ring (as indicated by the perforations in the antero-posterior view X-ray) and in relation to the plane of the limbus as indicated by the ring in the lateral view.

The Indian ink marks, showing the exact meridian in relation to which the localisation has been given, enables the operator to utilize the information given by the radiologist with great accuracy.

Bone-free X-rays.—This was done in four cases where ordinary X-ray examination was negative, and in one case revealed a minute foreign body in the lens.

Nature of missile.—The grenade : shell ratio was 1 : 0·6, grenade : mine or booby trap 1 : 0·2, and grenade : aerial bomb or mortar 1 : 0·4.

An analysis of 39 cases with positive X-ray finding of F.B. showed that whereas a grenade was 40 per cent. less likely to be X-ray positive than a shell, a fragment of grenade was three times more likely to be X-ray positive than a particle of mine or booby trap.

Removal of foreign bodies.—A grenade F.B. was three or four times less likely to be extracted than a fragment of shell.

Forty-seven per cent. of foreign bodies were extracted, 24 per cent. with the electro-magnet and 23 per cent. by other methods. Of the foreign bodies situated in the vitreous, one-third was extracted with the magnet by the posterior route. Four foreign bodies situated in the iris or lens were extracted with the magnet by the anterior route.

Cause of defective vision.—An analysis of cases with visual acuity of 6/60 or less showed that in only two cases could this be attributed to operative interference. In the remainder the defect was due to the original, trauma, most commonly dense vitreous haemorrhage (61 per cent.) or cataract (26 per cent.).

Disposal.—Thirty-four per cent. were repatriated because of the eye condition, and 14 per cent. on account of a general condition. Fifty-two per cent. returned to duty, 9 per cent. in the same category and 43 per cent. in a lower category.

Double-perforating (traversing) injuries

There were 20 such cases, which is roughly one fourth of the number of cases which had intra-ocular foreign bodies. All the cases showed either a penetrating corneal wound with iris hole, or cataract or a scleral perforation. All showed either X-ray evidence of an orbital foreign body or an area of proliferative choroiditis (as described by Michaelson and Kraus), or both. The incidence of these diagnostic criteria was as follows :—

		Per cent.
(1)	Penetrating scar with iris hole or cataract	60
(2)	Scleral perforation	40
(3)	Both X-ray evidence of orbital F.B. and a visible area of proliferative choroiditis	20
(4)	Area of proliferative choroiditis without X ray evidence of F.B.	20
(5)	X-ray evidence of orbital foreign body but no visible proliferative choroiditis	60

The main features of damage to the globe at the time of injury were :—

	No. of cases
Uveal prolapse	3
Iris hole	4
Lens opacity	10
Vitreous haemorrhage	9
Cone of vitreous opacity leading to exit wound	3
Retinal detachment	4
Proliferative choroiditis...	8
Very low intra-ocular pressure...	7

Of the four cases of retinal detachment, two were enucleated because of commencing atrophy of the globe, and two had successful operations.

Characteristics of damage to the globe from double perforating injury are:—

(1) A mass of proliferative choroiditis at the exit wound.

(2) A cone of vitreous opacity narrowing back to the exit wound, and marking the track of the foreign body.

(3) A tendency for the eye to remain soft.

Contusion injuries

These were present in 47 cases involving 52 eyes. In each case there was evidence of impact of the missile on the globe, without perforation. In 36 eyes there was a penetrating F.B. of the eyelid, orbit or coat of the globe. In the other cases the F.B. was not detected, or may not have penetrated sufficient tissue to be retained.

The following is an analysis of the damage done to the globe:—

	No. of case
Retroverted iris	2
Iridodialysis	1
Mydriasis	1
Scleral rupture	3
Hyphaema	8
Cataract	1
Vitreous haemorrhage	38 (73 per cent.)
Choroidal haemorrhage	6
Choroidal oedema	6
Choroidal rupture	3
Retinal haemorrhage	10
Retinal oedema	6
Detachment of retina	1
Chronic glaucoma	2
Ophthalmoplegia	3
Avulsed optic nerve	1
Hypotension	5

Scleral ruptures.—All were at the site of impact of the F.B.

Vitreous haemorrhage.—In about 25 per cent. the haemorrhage was localised towards the site of impact of the foreign body. In several cases of long standing, the haemorrhage appeared to be

transformed into dove-grey filmy opacities through which red islands of fundus were visible.

Choroidal ruptures.—All the choroidal ruptures were localised to the site of impact of the F.B. For some time a pre-retinal haemorrhage concealed the choroidal change.

Retinal haemorrhage and oedema.—In about half of the cases the changes were localised to the site of the impact. In addition to such localised haemorrhage one case showed oedema of the macula which ultimately developed the appearance of a macular "hole."

The final visual acuities in these cases were as follows:—

	No. of cases	Percentages
Enucleation	2	4·0
Count fingers or less	20	41·0
6/60—6/36	3	6·0
6/24—6/18	6	12·0
6/12 or better	18	37·0

The causes of final visual acuities of 6/60 or less in 24 eyes were as follows:—

	No. of cases
Vitreous haemorrhage	14 (58 per cent.)
Choroidal changes	1
Retinal changes	5
Scleral rupture	2
Glaucoma	1
Avulsed optic nerve...	1

Concussion injuries

There were 26 eyes with such injuries. In these cases there was no evidence of the impact of a missile on the globe. In several cases the diagnosis was not made until months after the injury owing to the absence of gross visual disturbance.

The following were the chief changes noted:—

	No. of cases
Corneal opacity	1
Scleral rupture	1
Hyphaema	4
Mydriasis	3
Cataract	4
Dislocated lens	1
Vitreous haemorrhage	13 (52 per cent.)
Retinal haemorrhage	4
Retinal detachment	3
Retinal commotion	4
Choroidal rupture	4
Choroidal haemorrhage	2
Hypotension	4
Orbital haemorrhage with papilloedema ...	1

The corneal opacity was a mid-proprial, tri-radiate one. A similar change was seen in another case not included in this series.

Two of the retinal detachments showed tears in the temporal side while one showed a temporal dehiscence. All these cases had unsuccessful operations. In each case the eye was soft or became soft after the operation.

The visual acuities of the four cases of "commotio retinae" were as follows:—6/24 on 56th day; 6/12 on 31st day; 6/24 on 119th day; 6/6 on 62nd day.

The choroidal haemorrhages were flat and map-like.

The nature of the causal force.—In sixteen cases the concussion was "air-conducted." Shells, land mines or booby traps caused the injury in most of these cases, but all types of missiles were represented. Practically all cases were within 10 yards of the explosion.

In 10 cases the force was "tissue-conducted," chiefly as the result of a face traversing missile. One case showed a foreign body impacted in the temple, while another resulted from a blow on the orbital margin from binoculars which were hit by a missile while the officer was making observations.

There was no case of "water conducted" concussion.

The nature of the damage to the globe in the 10 cases of "tissue conducted" concussion was as follows:—

	No. of cases
Retinal haemorrhage	4
Retinal commotion	4
Choroidal haemorrhage	1
Choroidal rupture	3
Vitreous haemorrhage	1

It is noteworthy that in these cases only one eye showed a lesion anterior to the fundus. In this case the vitreous haemorrhage was associated with a retinal one. This is probably characteristic of "tissue-conducted" concussion, whereas an "air-conducted" force impinging on the anterior surface of the globe is capable of causing changes in the cornea, lens, iris, and ciliary body, as well as in the fundus. Professor Feigenbaum of Jerusalem, in a personal communication, confirmed the regularity with which the "tissue-conducted" force caused changes in the fundus and not in the anterior eye. It would appear that the "tissue-conducted" force, transmitted as it is by the orbital fat to the globe, impinges on the posterior segment and therefore has an effect limited for the most part to the choroid and retina.

The causes of final acuities of 6/60 or less in 15 cases were as follows:—

	No. of cases
Vitreous haemorrhage	7
Cataract	2
Choroidal rupture	2
Retinal detachment	3
Retinal haemorrhage ...	2

Points of comparison in injuries from various types of missile

Some of the main points of comparison in injuries from various types of missile are summarised in Table III.

TABLE 3

SOME POINTS OF COMPARISON IN INJURIES CAUSED BY VARIOUS TYPES OF MISSILE.

GRENADES
MINE OR BOOBY TRAP
SHELL
AERIAL BOMB OR MORTAR
GUN SHOT WOUND
MISCELLANEOUS OR UNKNOWN
RATIO IN 301 CASES OF INJURY TO EYE.
RATIO IN 56 CASES REQUIRING PRIMARY EXCISION OF THE GLOBE.
RATIO IN 138 CASES OF PERFORATING INJURY
NIL.
RATIO IN 78 EYES WITH INTRA-OCULAR FOREIGN-BODIES.
NIL.
RATIO IN 39 CASES OF INTRA-OCULAR FOREIGN-BODY WITH POSITIVE X-RAY.
NIL.

(i) Bullet and mortar wounds were the most damaging to the eye. Grenades on the other hand were the commonest cause of perforating injury to the globe.

(ii) A fragment of grenade was 40 per cent. less likely to be X-ray positive than a fragment of shell, but was three times more likely to be positive than a particle of land-mine or booby-trap. Mortar particles were more commonly positive than grenades but less commonly positive than fragments of shell.

Fragments of shell were three times more likely than grenades to be extracted by the electro-magnet. Mortar particles were more readily extracted than grenades but less commonly than shell fragments. Mines and booby-traps had the worst prognosis in regard to successful extraction, but the number in this series was too small to allow of accurate comparison.

Principal causes of serious visual defect

The main causes of serious visual defect (6/60 or less), in cases of perforation, contusion and concussion, are summarised in Table IV.

TABLE IV

	PERCENTAGES			
	Vitreous haemorrhage or opacities	Traumatic Cataract	Choroido-Retinal Conditions	Miscellaneous
Perforation ...	63·0	25·0	12·0	—
Contusion ...	58·0	2·0	25·0	15·0
Concussion ...	50·0	13·0	37·0	—

From whatever reason an eye might be lost infection appeared to be a negligible factor.

Summary

1. Three-hundred-and-one cases of battle-injury to the eyes have been analysed and "followed-up" until the men concerned were either repatriated or had returned to duty.

2. There were fifty-eight patients (19 per cent.) with bilateral injury, twenty-three (7·6 per cent. of the total and 40 per cent. of the bilateral cases) becoming certifiably blind.

3. In approximately 80 per cent. of injuries caused by grenades,

land-mines, or booby-traps, the explosion occurred within 3 yards (Table I).

4. Of the foreign bodies situated in the vitreous approximately one third were extracted with the electro-magnet by the posterior route.

5. *Effect upon Function.*—Forty per cent. of all cases of severe injury to the eye retained useful vision, 20 per cent. having 6/12 or better. In a further 16 per cent., however, the defect was due to uncomplicated cataract, the eye being therefore potentially useful.

The final visual acuities in cases of perforation, contusion and concussion are compared (Table II), concussion being less destructive than contusion, and perforation being considerably more serious than either in its effect upon function.

6. A distinguishing feature is indicated between the clinical findings in air-conducted and tissue-conducted concussion injuries to the globe. The pathogenesis of this distinction is suggested.

7. The principal causes of serious visual defect (6/60 or less), in cases of perforation, contusion and concussion, are summarised in Table IV. Infection appeared to be a negligible factor.

8. No case of sympathetic ophthalmia is recorded.

9. A follow-up of 249 cases showed that over 60 per cent. returned to full-duty.

We wish to thank Major-General J. C. A. Dowse, C.B.E., M.C., Director of Army Medical Services in the Middle East, for permission to publish this paper, and to express our indebtedness to all the Ophthalmic Surgeons who have served in this Command, whose accurate records made possible this analysis and follow-up.

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ANNOTATIONS

The special hospital

The Joint Committee of the King Edward's Hospital Fund for London and the Voluntary Hospitals Committee for London have issued a brochure entitled "Some Aspects of the Post-War Hospital Problems in London and the Home Counties." In Section VIII there is a discussion about Special Hospitals. There are those who think that there is no case for the separate existence of special hospitals. The points against the special hospital are isolation from contact

with general medical work and the attendant danger of over-specialisation. In the majority of special hospitals, particularly those that are small (*i.e.*, less than 50 beds) the ancillary services, such as pathology and radiology, may not be of the standard requisite for absolute efficiency. And there are those who, on the other hand, consider that a higher standard would be achieved if all work in connection with the specialities was carried out in hospitals entirely devoted to them.

Many of the special hospitals have come into being because of cramped conditions, inadequate equipment and failure of proper recognition of the needs of a particular speciality at general hospitals.

In London the balance is on the whole nicely kept by members of the honorary staff of the teaching hospitals serving also on the staff of one of the larger special hospitals. The pooling of knowledge of these experienced specialists at the special hospitals has done much to enhance the international reputation that several such hospitals have earned. The large special hospital plays a particularly important part in post-graduate training for only here is it possible to collect a fair number of interesting and rare cases. The special departments of teaching hospitals are primarily concerned with under-graduate teaching and indeed might be embarassed to deal adequately with the needs of the post-graduate.

So it would seem that such extreme views as the abolition of the special departments in the general hospitals and the concentration of all special cases in special hospitals, or the closing of special hospitals and the distribution of their cases to the special departments of general hospitals are insupportable.

The solution probably lies between these extremes. The report suggests that the smaller special hospitals be closed, and that so far as London is concerned, there are formed a series of institutes in the various special subjects, each institute being based on the most suitable special hospital in its particular subject. The aim should be to have one institute in each of the principal special subjects. As a first step, at least one special hospital in each major special subject should be brought up to university standard in respect of staffing, accommodation and equipment, and should be assisted to establish an institute for post-graduate education and research. In some specialities two or more hospitals might take part in the establishment of an institute.

In this way the traditions and the high standards of work of such special hospitals will be maintained and even improved. At the same time it is hoped that the special departments of the large teaching hospitals will be given better facilities to deal with the waiting lists which the reputation of their staffs on the one hand and the limited allocation of beds on the other have combined to bring about.

" Though an angel should write, still 'tis devils must print "

Sherlock Holmes once confessed that when he was very young he confused the *Leeds Mercury* with the *Western Morning News* and stated that, to his eyes, there was as much difference between the leaded bourgeois type of a *Times* article and the slovenly print of an evening halfpenny paper as there could be between the skull of a Negro and that of an Esquimaux to those of Dr. Mortimer. Types, paper and printing have made great strides since the year 1902 when " The Hound of the Baskervilles " was published. We hope that the article by Mr. R. B. Fishenden in this issue will be widely read by our subscribers. He is a recognized authority on this subject and we count ourselves extremely fortunate in getting him to write us a paper which has so great a bearing on ophthalmological problems.

Improvement in the legibility of type has been made empirically by printers. Thus, the introduction of serifs came about without knowledge of the fact that the increased legibility is due to the counteraction of irradiation. Unfortunately book lovers, and particularly purveyors of special presses, such as the Kelmscotit, have been more concerned with the beauty of the printed page than with legibility.

The legibility of individual letters, however, is only a small, though fundamental element in reading. Only children and people learning a foreign language or a new script pay minute attention to the letters themselves. A line of print is read in a series of small jumps. At each pause a group of about ten letters is more or less accurately visualized. Hence rapidity and accuracy in reading depends not only upon the legibility of letters, words and groups of words, but also upon highly complex psychological factors. The physiology of reading was made the subject of an experimental investigation many years ago by Javal. It is a pity that his work received little notice, and the book is out of print. Very little advance in our knowledge has been made since his work.

During the past five years war conditions have necessitated many drastic alterations in the supply and quality of the paper used for printing and we hope that by this time next year matters may be much nearer the pre-war standard. We may be prejudiced, but we think that paper and printing of pre-war numbers of our journal were in the first class. This we owe to the care and interest which George Pulman and Sons have always taken in their work.

ABSTRACTS

I.—MISCELLANEOUS

(1) **Snell, A. C. (Baltimore).—Perforating ocular injuries.**—*Amer. Jl. Ophthal.*, Vol. XXVIII, p. 263, 1945.

(1) **Snell** gives an analysis of 172 cases of perforating ocular injuries. He finds that recovery is unfavourable in (1) injuries by blunt objects; (2) through and through wounds of the globe; (3) severe degree of prolapse of intra-ocular contents; (4) severe intra-ocular haemorrhage. He comments that recovery is not consistently influenced by either the length of the laceration or its location; by injury to the lens; iris prolapse and lesser degrees of haemorrhage. The incidence of sympathetic ophthalmia in these cases is 1·45 per cent.

The author found that in the repair of corneal wounds either the conjunctival flap or direct corneal sutures appeared to be about equally effective.

H. B. STALLARD.

(2) **Wetzel, T. O. (Lansing, Michigan).—Dacryocystitis: the part played by syphilis in its etiology.** *Amer. Jl. Ophthal.*, Vol. XXVIII, p. 511, 1945.

(2) **Wetzel** comments that syphilis should be considered as an aetiological factor in dacryocystitis. Hitherto it has been regarded as a rarity. He describes two cases which he treated successfully by anti-luetic methods. One of these required dacryocystorhinostomy at a later date. The literature records cases of primary syphilitic lesions in the lacrimal sac and syphilitic periostitis in the bones adjacent to the naso-lacrimal duct, and in the nose.

H. B. STALLARD.

(3) **Small, F. M., Major, R.A.M.C.—Retained intraventricular foreign body.** *Brit. Jl. Surgery*, Vol. XXXII, No. 127, pp. 414-418, January, 1945.

(3) **Small** records a case in which a foreign body entered the skull by traversing the left orbit and finally migrated to the occipital horn.

A patient received an injury by a pistol bullet which passed through the left side of the hard palate, the maxilla and maxillary antrum, the left orbit, part of the left frontal sinus, and then through the left frontal lobe.

Radiography showed that the bullet was lying on the supraorbital plate and that it was mobile. At operation two days later the bullet could not be found, and after a radiological examination on

the table it was seen to have fallen into the ventricle and back into the occipital horn. Penicillin was injected into the track: fascia lata grafts sewn in place, the left eye removed and the wound closed.

Seven weeks later a cisternal encephalogram showed that the bullet was resting in the occipital lobe itself and still slightly mobile. To ophthalmologists it is interesting to note that at no time was the central or peripheral vision of the right eye impaired.

B. W. RYCROFT.

(4) **Neff, E. Eugene (Madison, Wisconsin).—Factors affecting haemorrhage following extractions of cataracts.** *Arch. of Ophthal.*, Vol. XXXIII, No. 3, p. 192, March, 1945.

(4) There is a considerable literature on this subject, and before decribing his own painstaking work, **Neff** gives a useful resumé of it, from which the following points emerge. A "constitutional moment" exists for the eye between the third and sixth day when it is particularly liable to develop haemorrhage from external pressure, and trauma is thus the commonest single cause of post-operative bleeding. This observation was supported by two observers carrying out a series of forty operations on private patients without a single haemorrhage, after tenotomy of the orbicularis has been performed. In a second series of fifty-two infirmary patients, however, nine haemorrhages were noted. Somewhat conflicting statements were made as to the importance of other factors, and it was to resolve these conflicts that the author's work was done. He investigated ninety-eight patients on whom a total of two hundred and five operations had been performed, and his findings were as follows:—The greatest frequency of haemorrhage was in intracapsular extractions combined with iridectomy, the percentage being 20·6 as compared with 7·6 when a preliminary iridectomy had been performed. The total incidence of hyphaema for the whole series was 11·2 per cent., trauma being instrumental in 48 per cent. of them. Males seem more likely than females to have traumatic episodes, since 80 per cent. of those who bled after trauma were men. Post-operative haemorrhage seems to have little relation to blood pressure until one compares the traumatic and non-traumatic groups when it is found that hypertensives are more likely to bleed without the added tension produced by trauma. A low platelet count predisposed to haemorrhage, as did a high haemoglobin level. The tourniquet test for capillary fragility gave some useful information. In the group of patients with two or fewer petechiae there were forty who did not bleed and eight who did, of whom six had trauma, while of fifteen with seven or more petechiae, six had post-operative bleeding, and in only two was trauma a factor. Coagulation time, and a past history of bleeding were unimportant factors.

In his summary the author suggests that preliminary iridectomy should be done whenever possible, and states that the most significant findings in the non-traumatic hyphaemas were high systolic and diastolic blood pressures, low platelet counts, low and high amounts of haemoglobin, capillary fragility, and increased blood coagulation times.

F. A. W-N.

(5) **Boshoff, P. H. (Johannesburg).—Blindness and diseases of the eye in South Africa.** *South African Med. Jl.*, Vol. XIX, p. 148, 1945.

(5) **Boshoff's** paper gives statistics of the blind Europeans in South Africa per 100,000 persons, which in 1908, 1911 and 1936 was 81·24, 76·47 and 81·06 respectively. His researches among the native population in the districts of Mafeking, Zeerust, Marico and Rustenburg lead him to suppose that the incidence of native blind is 1,800 in 100,000.

He emphasizes the need for constructive work to be done in the way of establishing clinics for the prevention of blindness, the treatment of eye diseases and research. He believes that in this way the wastage of money in pensions could be reduced to a fraction of its present figure.

H. B. STALLARD.

II.—CONJUNCTIVITIS

(1) **Julianelle, L. A. and Smith, J. E. (Saint Louis and Rolla, Missouri).—A statistical analysis of clinical trachoma.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 158, 1943.

(1) **Julianelle** and **Smith** have analysed 1,000 patients suffering from trachoma. Type I, 146 patients; type II, 364; type III, 326; and type IV, 164. 448 had received previous treatment and 552 had not. The figures indicate that with succession in type the need for repeated courses of treatment is more frequent. The source of infection was not determined in 387 cases; in 368, 60 per cent.; of the remainder the disease was contracted through the family. Pannus was not present in 37 per cent. of the patients in type I; in the others it was increasingly severe with the successive types.

Corneal scars were evident in 45 per cent. of all patients, types III and IV being most heavily affected. Corneal ulcers occurred in 10 per cent. Entropion requiring surgical correction was present in 12 per cent. with more than half the patients of type IV so affected. Only 1 per cent. of the patients in this series were totally blind.

H. B. STALLARD.

(2) **Julianelle, L. A. (Saint Louis).—Studies on the infectivity of trachoma.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 378, 1943.

(2) **Julianelle** records the attempts to adsorb trachomatous virus on bacterial cells in order to render it agglutinable by antisera obtained from patients, experimentally infected monkeys and rabbits. Other trials to show serological reactivity by fixation of combined antigen-antibody on collodion particles were likewise unsuccessful. These observations suggest that such sera are devoid of anti-viral antibodies.

H. B. STALLARD.

(3) **Berliner, M. L. (New York).—Epidemic kerato-conjunctivitis.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 50, 1943.

(3) **Berliner** describes the clinical features of an epidemic of kerato-conjunctivitis which occurred in the West of America in the autumn of 1941. The disease had a sudden onset with pain, like a foreign body in the eye, excessive lacrimation and marked oedema. On the second or third day the pre-auricular lymph node became enlarged and this subsided in a week.

Dirty grey membrane may form on the conjunctiva, removal of which leaves bleeding points. In 50 per cent. the other eye became infected within the first week. At the end of the second or third week the acute symptoms abate leaving a residual folliculosis which may continue for 4 to 8 weeks. Small discrete greyish infiltrates appear in the pupillary area of the cornea, the lesion being in the basal cell layer and Bowman's membrane.

Bacteriological studies have so far proved negative. A virus infection is suspected. The only therapeutic measure of any value to-date is local irrigations with a weak solution of sodium bicarbonate and the application of cold compresses. After the acute symptoms subsided dionine was used for the treatment of corneal opacities.

H. B. STALLARD.

(4) **Arnold, R. and Whildin, T. (Durham, North Carolina).—Rhinosporidiosis.** *Amer. Jl. Ophthal.*, Vol. XXV, p. 1227, 1942.

(4) **Arnold** and **Whildin** describe a case of rhinosporidiosis of the conjunctiva in a boy, aged 8 years, who had not been in contact with cattle and horses. The lesion was situated in the lower fornix of the right eye. It was polypoid in appearance, pedunculated, lobulated, reddish with yellowish white spots, and was painless.

Histological examination showed sporangia embedded in granulation tissue, some were filled with endospores and others were empty. In places where the sporangium capsule had ruptured there was an acute inflammatory reaction around the endospores and giant-cell formation.

H. B. STALLARD.

BOOK NOTICES

A Bibliography of Visual Literature, 1939-1944. Compiled by JOHN F. FULTON, PHOEBE M. HOFF and HENRIETTA T. PERKINS. George Banta Publishing Company, Menasha, Wisconsin. 1945.

The British Air Ministry requested the compilation of a classified bibliography covering all the literature on vision that might have some relevance in military operations on land, at sea and in the air. The compilers state that the classification adopted is to some extent arbitrary and is based primarily on presumed military usefulness. They have concentrated on the biological aspects of the subject and have felt it necessary to exclude aerial photography, optical engineering and optometry.

The literature on psychology has been searched through the medium of Psychological Abstracts, and Russian literature has been looked into.

This book is composed entirely of a list of references given in alphabetical order under main headings such as anatomy, physiology and psychology, visual examination and testing, correction of ocular defects in military personnel, training for military specialties ocular trauma, goggles and ocular protection, illumination and visibility. These subjects are subdivided. There is an index of authors and subjects and a key to the abbreviations of the journals cited.

This book is well produced. Its matter has entailed an immense amount of conscientious and painstaking work. It will be of particular value to those interested in ophthalmic medicine and surgery in the fighting services.

British Journal of Industrial Medicine. Vol. I, No. 4. London: British Medical Association, Tavistock Square, W.C.1. October, 1944.

We extend a cordial welcome to the first number of the *British Journal of Industrial Medicine* to reach us. The journal is a quarterly publication, the year's subscription being 25/- and the price of a single number 7/6.

The editor is Donald Hunter, the assistant editors, D. C. Norris and Donald Stewart, and there is an editorial committee of six, including A. J. Amor, Sir Henry Bashford, M. W. Goldblatt, R. Watson-Jones and the editor of the *Brit. Med. Jl.* The journal is printed in double columns to a page and the present number contains many interesting original papers. Besides original communications there are leading articles, reviews, an abstract section and the Proceedings of the Association of Industrial Medical Officers.

The illustrations are admirably reproduced. All concerned in the production of this new venture are to be congratulated on the excellence of the results.

CORRESPONDENCE

INTRA-OCULAR FOREIGN BODIES

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—In their interesting article on the removal of intra-ocular foreign bodies by the trans-scleral route, Messrs. Kraus and Briggs do rather less than justice to those who practised, taught and published this technique before the war; but perhaps they are far removed from reference libraries, and so may be forgiven. Now that the method has become established in this country it is as well to recall it's early struggles.

In this country the Haab magnet has always been more popular than the Mellinger, and the Haab is not ideal for the trans-scleral removal of foreign bodies. Perhaps for this reason the method has only been used as a last resort when all else had failed, and as the sclera was not sutured it is not surprising that the published results were very bad. I think I am right in saying that Cridland, in his Doyne Memorial Lecture on this subject, was inclined to the view that the results of extraction by the posterior route were so bad that there was little difference in the prognosis whether the foreign body was left in or removed.

In America, where many have used the posterior route as the method of preference, and not as a last resort, very different results have been obtained. The pioneer and arch exponent was William Sweet of Philadelphia, who had, by 1914, published the results of 1,000 cases treated by this method by his colleagues and himself. The results then compared favourably with those by any other method in any other country.

It is interesting to recall the somewhat lively meeting at the Ophthalmological Congress early in 1942, when I produced results in patients treated by the posterior route with suture of the sclera. They were mostly pre-war cases which had been followed up. The older members of the congress were mostly dead against the method, and I remember some of them being quite angry. It soon became clear that the modern operation differed so widely from the older operation practised by them that no exact comparison was possible. Now that the war has brought a glut of these cases, and has allowed

surgeons of experience to form a considered opinion of the best method of treatment, it seems clear that the planned transcleral method will have a considerable following in this country in future.

I am, Yours faithfully,

SEYMOUR PHILPS.

104, HARLEY STREET, W.1
November 18, 1945.

EXPERIMENTAL CORNEAL LESIONS

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—In their letter in your December issue, Dr. Robson and his associates reiterate their claim that they have evolved a satisfactory experimental lesion of the cornea for testing the efficacy of chemotherapeutic agents. My colleagues and myself have found these lesions too inconstant in course to serve such a purpose. Moreover, these lesions tend to heal spontaneously. Our criticism, far from being "uninformed," is based on a considerable amount of experimental and clinical work reported in your columns and elsewhere. We are satisfied that in repeating the work reported by Dr. Robson and his colleagues we have taken all the care that could reasonably be expected, even to such a detail as to use the specially bevelled needles they employed.

Incidentally, have hectic adjectives any place in a scientific discussion? They are not known to influence the rabbit's cornea.

Yours faithfully,

ARNOLD SORSBY.

THE ROYAL EYE HOSPITAL,
LONDON, S.E.1
December 10, 1945.

NOTES

Death

WE have learned that Professor Szily died suddenly in Budapest in September, 1945.

* * * *

Lectures on Motor Anomalies

THE Dartmouth College Publications, Hanover, New Hampshire, informs us that a third printing of Bielschowsky's Lectures on Motor Anomalies is now ready for sale at $1·50 per copy, postage paid.